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PULMONARY TUBERCULOSIS

ITS MODERN AND SPECIALIZED TREATMENT

WITH A BRIEF ACCOUNT OF THE
METHODS OF STUDY AND TREAT-
MENT AT THE HENRY PHIPPS
INSTITUTE OF PHILADELPHIA

3245

BY

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PULMONARY TUBERCULOSIS

ITS MODERN AND SPECIALIZED TREATMENT



CHAPTER I.

A PREFATORY WORD.

FROM a familiarity with certain broad principles of treatment in pulmonary tuberculosis there had grown up among the profession a widespread feeling that their application should be easy and the whole matter consequently quite simple. In practical experience the general practitioner found that this was not the case, or at least that he was not "curing" his tuberculous patients; and he at once fell back upon, or rather took unctious unto his soul in, scepticism as to the curability of the disease. He even went so far, from his tentative and, broadly speaking, ineffectual application of these much vaunted methods, as to look upon those who claimed much for them and who held out for the curability of tuberculosis, as either self-deceived or wilfully deceiving fanatics.

From the terrible days of whiskey, cod-liver oil, and a multiplicity of drugs, the pendulum had swung over to the almost equally pernicious theory

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of the futility of all drugs and special remedies. The profession were thus stranded between the horns of a dilemma by which they were confused and with which they were unable to cope. Out of this transitional quagmire modern methods of investigation and modern clinical experience, the results, in a word, of the unremitting efforts of those who have devoted their lives to the study of tuberculosis both in this country and in Europe, have, or are, surely lifting us; until to-day we recognize that many cases can be cured, that the life of many more may be prolonged, and we look forward to a time when by modern methods of prevention, tuberculosis will be an uncommon malady. The story of tuberculosis, yet to be written, will be one of the most remarkable in human as well as medical annals.

The part to be played by drugs or medicinal measures in this disease is coming to be pretty well recognized by the more advanced in this work. Nor is this meant so much in relation to curative effect, as of their value in the sense of tiding the organism over complications and symptoms. To-day we must recognize the fact that there is no drug, nor series of drugs, no special serum nor antitoxin, which is specific in the sense of being absolutely curative. However, the part to be played by drugs and culture products as adjuvants to the general treatment of tuberculosis, should be forcibly insisted upon. Much more can be done for these cases than merely supplying them with

fresh air, rest and good food. It would indeed be strange if modern advances in therapeutics and serumtherapy had accomplished nothing in this direction; if in this chronic disease, of all diseases, with its strong tendency to get well if uncomplicated by or relieved from mixed infection, there were not measures available in tiding the system over certain trying stages and complications. It has been not the use, but the abuse of drugs in the past which has brought them into such disfavor, and much of the following discussion will be given over to this phase of the subject.

The fact remains, of course, that there is no chronic disease requiring more persistent and watchful care, more absolute personal control on the part of the physician, than does tuberculosis. The doctor must regulate every little detail of the patient's life, must enjoy his entire confidence, must inspire him with his own enthusiasm.

Upon these two principles, *i.e.*, the general management; and the skilful application of remedies to meet complications; the modern and successful treatment of consumption depends.

It is not surprising that the treatment of tuberculosis should have become a specialty. It requires a special training, a special experience and, indeed, a special temperament for its successful application. So true is this that the laity have come to recognize it (though the general practitioner still thinks himself qualified to treat these cases) and they seek out at once, or sooner or

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later fall into the hands of those with expert knowledge and expert experience. The general practitioner, as he sets himself up in his views on this disease to-day, cannot treat tuberculosis with success, because he is not qualified to do so. He is too busy, too hurried; he cannot or does not give these cases the special attention which they require. Supposing that he is master of the factors entering into the diagnosis and prognosis of this disease, it is not a question of ability only, so much as of experience, time and unremitting attention.

It is for this reason that the disease in its early stages is so often overlooked. Too often it is want of detailed study of the chest by the family physician. The family physician of the future, the internal clinician, will come to recognize his responsibility in this regard, and at once a long step in the direction of prevention will be accomplished. Too often colds and bad throats and gripes are treated to-day with but a scant examination of the chest, and without the ever-present possibility of latent tuberculosis being in mind. It is a bad mistake and an irrational refinement of diagnosis to suppose that every person who is thin and run down has tuberculosis. Much harm and much discredit is put on expert work in the eyes of the profession at large, and the laity as well, by this unhappy and misdirected enthusiasm. But when the disease is once established, even in its earlier stages, it is easily recognized by careful

methods—often in a slight rise of temperature and slight rapidity of pulse; in a morning cough or “clearing up,” and in slight and irregular night-sweats. The physical signs in the lung are easily overlooked, but are sufficiently distinct in a slightly dull or higher pitched note over the diseased area, slight increase in tactile fremitus and vocal resonance, and in slightly higher pitched and prolonged expiration. Even at this early stage tubercle bacilli may be found in the morning mucus, not on the first or second examination, perhaps, but after repeated search for them. The physician who has reason to suspect the presence of tuberculosis, should never grow weary of examining the sputum. If this should prove negative, the physician should avail himself of the tuberculin reaction, to be described later, which is a perfectly safe procedure, and of the greatest circumstantial value. Treatment instituted reasonably early, even after the signs and symptoms are conclusive, but before mixed infection has taken place, or even after this has occurred, but before the process has spread much and before breaking down of tissue has supervened, gives the brightest promise.

For as we understand more clearly the morbid process and the course of pulmonary tuberculosis, it is becoming clear that the whole matter resolves itself, broadly speaking, into the study and treatment of mixed infections. The tuberculous process uncomplicated by this added factor is extremely slow, extremely favorable in its course,

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with a very strong tendency to get well. Pathologically it is a formative or constructive, rather than a destructive process. It tends to fibroid change and cicatrization, to thrombosis and sclerosis. It is the added factor of mixed infection which makes tuberculosis a dangerous and fatal disease. It is mixed infection which leads to the breaking down of pulmonary tissue and cavity formation, to the grave toxemias, to the occurrence of hemorrhage. Mixed infections are prevalent because they follow catarrhal inflammations of the nose and throat, of the air passages, and of the lungs themselves; and also follow general infective processes like typhoid fever and the exanthemata.

Therefore it is no exaggeration to say that the treatment of consumption resolves itself largely into the treatment of mixed infections.

Before taking up the subject proper of treatment, it would be well to briefly outline the modern views on infection and mixed infection.

INFECTION.

a. Tuberculosis may be directly inherited through placental infection. This is often spoken of as Baumgarten's theory, but has been repeatedly demonstrated by modern investigators, among whom may be mentioned Welch of Baltimore. The bacillus having reached the fetus through the maternal circulation may lie dormant or latent in the lymphatics of the new-born for

six months or longer, and yet the infection have been strictly hereditary. This is not considered to be a very common source of infection, though it occurs more frequently than is usually supposed.

b. According to Behring, tuberculosis is acquired in early life from the milk of tuberculous cows. It is thus a bovine infection, and the bacillus passes through the intestinal mucosa and lodges in the retroperitoneal and mesenteric lymphatics. It may remain in this situation and never give rise to infection of the lungs; or it may remain latent until puberty or later, when, under the stimulation of glandular activity or of some acute infection like pneumonia, or depressing factors in the subject's life, it becomes active and breaks into the lymph and blood currents and is carried to the lungs. This view, for a variety of reasons, possibly on account of the distinction of its author, possibly also from modern views as to the virulency and invasive power of the bovine type of the bacillus, is widely held.

In a later paper, Behring has modified or amplified his original statements by explaining that this primary bovine infection develops in the blood of the subject a resistance or immunity which manifests itself in an agglutinating property. Pulmonary tuberculosis may develop from the bovine infection; and, according to Behring, frequently does; but where this agglutinating power has developed in the blood, it manifests itself in a resistance to infection with the human type of the

bacillus, by "fixing" them, as it were, at the site of the primary invasion, *i.e.*, the lymph nodes,—and preventing, for a time at least, and within certain limits, their subsequent course to the lungs through the general circulation. He thus recognizes a secondary infection with the human type in some cases, and in this way accounts for the fact that the human bacillus is so frequently responsible for the secondary manifestations in the lungs.

c. The theory held by Koch, Cornet, Fluger, Ribbert and others is that infection arises from the inhalation or ingestion of living tubercle bacilli of the human type from the drying of sputum, or spray infection from the coughing of tuberculous subjects. Personally, I believe in this view and think that the majority, if not all cases of tuberculosis, are contracted from another case.

This theory of infection applies equally to children and adults. Children from their close association with their parents (if tuberculous) are thus likely to either inhale or ingest the bacillus.

Tuberculosis is pre-eminently a house-bred disease, arising from the contamination of houses. It is not contagious in the ordinary acceptance of that term. In the vast majority of instances it is contracted from living in a room or house which has been previously contaminated or is being contaminated by the carelessness of a consumptive. It requires a prolonged exposure for a successful implantation or inoculation with the tubercle bacillus. There is little if any danger in transient

association with consumptives, or transient exposure to contaminated places. Physicians are in little or no danger from their examination of and attendance on the tuberculous sick.

But it is the plague-invested areas of the slums which keep the disease continually alive; the filth and over-crowding, the squalor and starvation which furnish the fertile soil for the disease.

There are other methods of infection but they are negligible quantities when compared with tuberculosis arising as outlined above, *i.e.*, from inhalation or ingestion of the germ.

The older view, that the lungs were the seat of the primary infection, seems no longer tenable, certainly not in the majority of cases. Except where there are a great number of bacilli, inhaled *en masse*, as in inhalation experiments with animals, it is no longer believed that they attack and develop in the lungs primarily. If inhaled the bacilli pass primarily to the bronchial nodes; while if ingested, to the abdominal lymphatics,—in either case without injury or lesion in the intervening mucous membrane. From the lymph nodes the infection travels through the lymphatics to the thoracic duct and so reaches the lungs by the lymphatics and general circulation.¹ Thus lymph-node tuberculosis, either of the bronchial or mes-

¹See—Tuberculosis of the Thoracic Duct and Acute Miliary Tuberculosis. W. T. Longcope. Bull. No. 3. Ayre Clinical Lab. 1906.

enteric glands, is nearly always primary, and the pulmonary or other lesions secondary.

This theory of infection is consonant with clinical and pathological experience, both in relation to children and adults, the only difference being that in children the bacilli are latent for a more or less variable period in the lymphatics, while in adults the lungs are affected more rapidly through the blood and lymph channels. Though modern studies are tending to show that the disease is of much longer duration than is commonly supposed. The probabilities are that in the majority of cases infection takes place in infancy or childhood, though its manifestation in the lungs is not noted until much later. Flick thinks that the average duration of the disease is at least ten years, and I agree heartily with this view. With increased attention to this point we will be able to place the beginning of infection much earlier in these cases than has been usual hitherto.

Real scientific research into the duration of tuberculosis is only beginning. In the past, medical men have usually measured the duration of the disease by the period of mixed infection, and to a very great extent this is still done. The correct duration of the disease, however, should be measured from the implantation, and this implies a long period of dormancy in most cases. The probabilities are that tuberculosis is always primarily a lymphatic disease, and that the lymphatic period is always dormant except when the disease manifests itself by enlarged superficial glands.¹

¹Second Annual Report of Phipps Institute.

In connection with the difference in site of its localization in childhood and adult life, *i.e.*, in the glands and the lungs respectively, Dr. Theobald Smith's¹ views are striking and well worth quoting. He explains the localization in the lungs, which are in direct communication with the sistance (not susceptibility) on the part of the human body. The bacillus reaches the glands primarily but is not able to remain there, the system making an effort to throw it off. The bacillus must have both a port of entry and exit from the body to maintain its continued existence as a parasite. Consequently it tends to attack the lungs, which are in direct communication with the exterior. Lowered virulence or lowered invasive power is only another expression for localization on the external surfaces, among which the respiratory tract may be placed. Lymph-node tuberculosis (and other aberrant forms like that of the bone, kidney, brain and spinal cord) are most frequent in childhood because the tubercle bacillus being, as it were, keyed to adult life, is for that reason more invasive for childhood. In other words, the fact that the bacillus remains in the lymph nodes in children, is evidence that the system cannot throw it off, the effort at elimination is not sufficiently great to throw the bacillus into the lymph and blood stream and so get rid of it. In adult life, the body exerts this power, but in the

¹The Parasitism of the Tub. Bacillus, Jour. A. M. A., Apr. 28, 1906.

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process of elimination, the bacillus settles in the lungs, where it finds its requirements for a life of parasitism in a port of exit and entry.

It was, then, up to quite recently, held that tuberculosis was the result of inhaling the bacillus, which lodged directly in the lung. This seemed the natural and easy way of explaining the localization of the lesions of consumption. But modern study and experimentation have changed this view. Behring's contention of the importance of the intestinal tract as a medium of infection led the way. But his corollary of this, that it was most frequently a bovine infection, is not generally accepted. Recently the anatomical and pathological studies of Harbitz¹ of the distribution of lesions, particularly in children, seem to add weight to the view that the primary infection takes place through the gastro-intestinal tract. Additional evidence of an experimental nature has lately been furnished by Calmette and Guerin, of Lille.² They found that following the introduction into cattle and goats of a single dose of virulent tubercle bacilli, through an esophageal tube which protected the respiratory tract from direct infection, there developed in 30 to 45 days, subpleural and peribronchiolar tubercles at the tops and anterior borders of the lungs. These lesions were at first intracapillary, but later invaded the alveoli of the lung. The inference may thus be

¹Jour. Infec. Dis., 1905.

²Ann. de l'Inst. Pasteur, 1905, vol. xix, 1906, vol. xx.

drawn, not only from these experiments, but those of others, that the bacilli, passing through the gastric and intestinal mucosa, are taken up by the leucocytes of the blood and conveyed to the regional or abdominal lymph nodes; from here they find their way to the thoracic duct, and through the circulation in the capillaries invade the lungs and thoracic lymph nodes.

But whether this view is correct or not, matters little in relation to prophylactic measures, as the sputum still remains the source of the danger, and the precautions against infection remain the same whether we fear to inhale the germ or to take it into our alimentary tract through food or drink, or contaminated hands or other articles. From a practical point of view the same is true of Behring's much vaunted theory—for whether tuberculosis arises from drinking milk from tuberculous cattle or not, will not alter fundamentally our objection, if only on sanitary and ethical grounds, to consuming as food any and all tuberculous products.

MIXED INFECTION.

The toxemia of tuberculosis (*i.e.*, hectic fever, rapid pulse, sweats, chills, etc.) arises from the action of the toxins, not alone of the tubercle bacillus, but principally of other pathogenic micro-organisms, which soon complicate the primary tuberculous infection. By mixed infection, then, is meant the presence of other micro-organisms, prin-

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cipally streptococci, staphylococci, pneumococci and influenza bacilli, which may be found in the sputum ante-mortem and in the lungs and other organs of the body post-mortem. It is the toxins of one or more of these mixed infections, for they are usually multiple, which give rise to the distressing symptoms of consumption or phthisis. In the early stage of pulmonary tuberculosis, before mixed infection has taken place, these symptoms are absent or so mild as often to escape attention, and it is in this stage that the disease is practically always curable, and hence the importance of early diagnosis. The most common organisms producing mixed infection are streptococci, of which there are various strains or types, some producing a more active toxin than others. These may be found in the sputum of nearly all advanced cases, and may also usually be cultured from the lungs, liver, kidneys or other organs of the body after death. Staphylococci are less frequently found. The pneumococcus is more frequently present than would be thought from a microscopic examination of the sputum alone, as in many cases where it is not discoverable by staining methods, it may be demonstrated by animal inoculation. The influenza bacillus is not particularly common, though it does occur, and again is best demonstrated by inoculation. There are a variety of other organisms, among which may be mentioned the colon bacillus, causing mixed infection, but the principal offenders have been mentioned above.

Clinically, mixed infection in tuberculosis may arise insidiously, though usually it may be more or less definitely attributed to some acute infection like pneumonia, pleurisy or influenza. The older view that pneumonia and typhoid fever, and other acute infections were often followed by the development of tuberculosis, is now recognized as erroneous, in so far as it failed to appreciate that tuberculosis is really the primary condition. The tuberculosis has been unrecognized until the acute infection comes along, and by the introduction of these other pathogenic bacteria, lights up the dormant or latent primary disease. Mixed infection furnishes the local factors for the destruction of lung tissue, and produces new and poisonous toxins. The patient has had tuberculosis for ten years or longer, but neither himself nor his doctor nor his family suspect it. He gets an acute infection, which by the introduction of these other pathogenic bacteria lights up the primary infection, and produces definite and easily recognized symptoms.

In conclusion, then, of this brief consideration of these interesting phases of the subject, I would say that tuberculosis arises in the vast majority of cases, both in childhood and adult life, from the inspiration or ingestion of tubercle bacilli from a previous case of consumption; that the principal source of infection is the drying of sputum and the contamination of dwellings; and that the primary lesion is in the lymph nodes, either thoracic

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or abdominal, the lungs being secondarily infected. The symptoms of pulmonary tuberculosis are due in great part to mixed infections, of which the commonest are streptococci, staphylococci, and pneumococci; and the treatment of this disease largely resolves itself into the treatment of these mixed infections.

What can be said then of the curability of this disease? It often gets well of itself as manifested by healed lesions in the lungs found at autopsy of cases dying of other causes. If recognized before mixed infection takes place it is practically always curable.

Could all cases of tuberculosis come under treatment when either one part of one lobe of the lung is involved or the disease is still confined to the lymphatic glands or to a single organ of the body, there would need be no mortality from tuberculosis.¹

Even after mixed infection has taken place and the process has become more acute and malignant there is a strong tendency to recovery if caught before the inroads have been too great or too much tissue has been destroyed directly in the lungs, and indirectly or functionally by the action of the toxins on the heart and other organs.

The bacillus naturally tends to a life of parasitism, modifying itself to the particular soil upon which it has become engrafted, and the soil in turn modifying itself to the accommodation of the par-

¹Second Annual Report of Phipps Institute.

ticular bacillus infecting it. The more chronic the disease in a particular case, the better are the chances of getting well, because then this mutual adaptation has time to work itself out, and the patient is steadily developing an immunity to that bacillus.

Many of the more advanced cases can be restored to a life of comfort and even perhaps usefulness. The life of the patient in advanced cases may often be prolonged for years. The curability of the disease depends on many factors, not alone upon the stage of the disease and its virulency or chronicity, but upon individual immunity, the circumstances of the patient's life, his mental viewpoint and his intelligence and strength of character in co-operating in the treatment. Dr. Flick¹ well points out the factors entering into the prognosis in tuberculosis as depending on:

a. The virulence of the tubercle bacillus. *b.* The dose. *c.* The resistance of the host. *d.* The co-existence of other micro-organisms. *e.* The amount of tissue which has been destroyed. *f.* The duration of the disease. *g.* The complications arising from toxemias. *h.* Age. *i.* Race. *j.* Social conditions. *k.* Environment. *l.* Financial resources. *m.* Temperament. *n.* Character.

It cannot be doubted that when an individual has been "cured" of tuberculosis in the sense of having had complete fibroid transformation or isolation of the local process, he remains practi-

¹Amer. Med., Jan. 6, 1906.

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cally and permanently immune to the original infection; and enjoys a resistance greater than a normal individual against a fresh infection. This cure must not, however, be confounded with those cases in which there has developed a complete immunity to the toxins, while living bacilli still exist in a low grade chronic inflammation, giving rise to no symptoms. Nor again with "arrest" of the disease, in which there is complete quiescence of the tuberculous process, but the lesion in the lung remains unprotected by adequate fibroid change.

As to the good in general of all the work which is being done in tuberculosis, particularly in reference to hospital and dispensary work among the poorer classes, I should like to quote the fair and conservative statement in the closing paragraph of the introductory chapter of the Second Annual Report of the Phipps Institute. Embodying as it does the experience of a leading and life-long worker in this field, this statement is affecting in its sincerity, its optimism, and its limitations.

What, then, is the good of all the work that is done? The good comes from the prevention which is brought about. Treatment of these poor people and prolongation of life give opportunity to teach those who have the disease and those about them methods of prevention. All who have not yet had an implantation can be protected against implantation; many of those who have had implantation and in whom the disease is not far advanced can be saved from the full development of the disease; of those who have the disease in a fully developed stage, most will have to die. The fruit of the labor is in

the saving of those who are still in health. That this can be accomplished permits of no doubt. Reduction in the death-rate from tuberculosis in all places where preventive measures have been practiced firmly establishes this fact. Reduction in the future will be even more rapid than in the past. The benefit of the work is cumulative. With every abatement of a source of infection the opportunity for a new implantation grows less. Every year there are fewer foci to look after, and the facilities for the control of existing foci become better.

Finally, let me say that the treatment of pulmonary tuberculosis is a large subject and one difficult to present adequately for a variety of reasons. Every physician draws different conclusions from his own experience—even from the same experience—according to his temperament and his judgment. That is what is elegantly termed, the personal equation. As Hippocrates well says, and his axiom, while applicable to medicine in general, is particularly so to tuberculosis: “Experience is fallacious and judgment difficult.”

It is hardly to be supposed that anyone's opinions or methods would meet with unqualified assent. I can only offer what follows as the result of my experience and my judgment. In a chronic disease like tuberculosis, subject to unexpected change for better or worse, it is hard to judge dispassionately of a given remedy, because coincidence must always be reckoned with. Improvement or the reverse, often coincidental in these cases, will inevitably color the clinician's views in regard to certain measures, unless he weighs the various factors well in the balance. I have fol-

lowed well established principles, and have had no pet theories nor remedies to exploit. I have tried to be as conservative as is consistent with the modern advance in phthisiotherapy; and I have only expressed convictions, not alone mine, but which seem warranted and established by the best and widest clinical and experimental experience. I have drawn freely on the experience and ideas of others, giving credit wherever it was due, so far as lay in my knowledge or power. From the great mass of literature on tuberculosis, I have selected only the experience and the opinions which were in my judgment most valuable,—except in a few instances where the distinction of the author gave his views an authority which, while not endorsing, I was not warranted in disputing.

It is only fair to my colleagues of the Phipps Staff to say that I have assimilated much from our discussion of methods of treatment and drugs at our weekly staff meetings; and that while not in any sense responsible for the views or methods outlined below, much of what follows is colored by this combined experience.

CHAPTER II.

REST; FRESH AIR; EXERCISE.

IN the management of a case of pulmonary tuberculosis the first question which presents itself is that of rest. This depends as to whether it shall be absolute in bed, or dressed but on a lounge, or semi-recumbent in a reclining chair, upon the condition of the patient as manifest in the temperature and pulse. These two gages are fairly indicative of the activity of the tuberculous process in the lungs. If the process is progressive and there is cardiac irritability, or weakness and anemia, rest is essential. In general it may be said that a maximum amount of rest and fresh air are indicated in all cases with fever. It follows, therefore, that patients should give up work and devote themselves, body and soul, to the business of getting well. For it is not a trivial matter and will require great singleness of purpose and great consistency and perseverance, and great sacrifice on the part of the patient to follow out the rigid and trying restrictions necessary to the best results. It is not, of course, possible for all cases to give up their work, nor is it in all cases essential; but even in hospital or dispensary practice it is half the battle if the patient can be made to give up work and sleep out of doors, as insisted upon by Pratt of Boston.

Patients with a temperature above 101° F. and a pulse around 120 or above, should be rigidly confined to bed in the open air or in a well-ventilated room, until the temperature and pulse come down. This is the only logical and successful way of handling these cases, though it may take weeks to accomplish this result. If sleeping out of doors, patients should, of course, be protected from taking cold. They are in little danger of this if properly clothed and the bed covering is sufficiently warm. Wool should be worn next the skin, varying in weight with the time of year. In winter a high-necked flannel shirt and flannel underdrawers should be worn under the nightgown or pajamas, and the patient well protected with gloves and cap. Change of temperature from day to day, or at nightfall, requires re-adjustment of the wraps or bedclothing. Patients should always be sufficiently warmly clad to prevent them feeling chilly, though the skin should never be moist or the body in a sweat. Aside from the proper regulation of the dress, another danger of taking cold is in the visits of those with colds, tonsillitis, bronchitis or influenza, as all acute inflammations of the respiratory tract are more or less contagious.

The ideal place for consumptives, even though confined to bed, is in the open air. This is not essential, however, and almost if not quite as good results may be gotten in a sunny, airy room. The best exposure is of course to the south, and the windows should be kept wide open both day and



FIG. 1.—Temperature range 101°–102° F. Taking the cure under ideal circumstances. Absolute rest in bed in the open air.

night, in all kinds of weather, except the most inclement. The patient must not fear the blowing of the air upon him as he lies in bed. I would not recommend placing a patient's bed directly in a strong draft, particularly in cold weather, though the dangers of drafts are much exaggerated.

Even in the crowded sections of cities, however, with patients of small means and straightened surroundings, every effort should be made, particularly as they begin to improve, to getting their bed out of doors. With ingenuity and a little personal supervision from the doctor, the roof or back porch or yard may be made use of, and the patient may camp out in the heart of the city with all the advantages which are usually associated, in the popular mind, with residence in the country. Pratt of Boston has been particularly successful in carrying out this plan with working people of small means, treated from the dispensary of the Massachusetts General Hospital. A cheap canvas tent may be bought, and in fair weather the sides and top may be rolled up. A maximum amount of sunlight should be secured, except in very hot weather when the direct rays of the sun will increase the temperature. The same is true of fresh air, except high winds, which affect the respiration and pulse unfavorably.

The length of time which it may be necessary to confine patients to bed should not be definitely stated to them, but they should be told that it may take many weeks before the temperature and pulse

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come down. The time varies greatly in different cases according to the extent of involvement, the stage of the disease, the character of the mixed infection, and the vitality or recuperative power of the patient himself. It is often necessary in well-advanced cases to keep a patient in bed for eight or twelve weeks. Incidentally it may be said that all their symptoms improve under this treatment. It is practically the only method of controlling cough. After a week or two, the cough becomes much less disturbing and may even cease to be a factor. The same is true of nightsweats and chills. Patients soon begin to gain weight in bed.

A few cases whose temperature would warrant their being confined to bed but whose general condition is good, may be permitted to recline dressed on a lounge or cot. Sometimes the idea of being in bed (though this need not be so if the situation is properly explained to the patient and his relatives and they are reasonably intelligent) has a depressing effect on low-spirited patients, which may be so marked as to counteract the benefit of the routine application of this important principle. This is a somewhat dangerous variation to enunciate, however, and it should be remembered that the best routine practice is bed.

If the temperature is consistently below 100° and the pulse of good volume and tension, the patient should be permitted to spend eight or twelve hours in a reclining chair out of doors.



FIG. 2.—Temperature range 89.5°-101° F. Patient spent six to eight hours a day, dressed, on lounge on roof during fair weather of spring and early summer, until heat of sun became a factor. Subsequently, during hot weather, he went to White Haven. There was no yard. It should be noted that patients in the open air should be protected from high winds or the direct rays of the sun when these are factors, as by tents or lean-tos.



FIG. 3.—Street in the slums on which the patient shown in Figure 2 lived. Arrow marks house.



FIG. 4.—Taking the cure under difficulties. Patient spent six to eight hours a day during fair weather on this slanting roof. Temperature, $99\frac{1}{2}^{\circ}$ F.



FIG. 5.—Blind alley off which patient shown in Figure 4 lived.

The chair should be comfortable, with support for the legs and feet, and of such an angle that the patient cannot write much or do any work. The rest in tuberculosis must not be haphazard, subject to the interruptions of visitors and exciting conversation or games. Patients should read and doze and dream under blue skies, with the attention of an intelligent nurse; their food and milk and eggs should be brought to them; and under this quiet and orderly regimen the time will pass not too wearily. They should maintain a cheerful frame of mind and never lose sight of the object of their efforts, the business of getting well. The effect of the rest and fresh air and nourishment is so marked in these cases that the spirits improve rapidly under the influence of improved bodily nutrition.

Minor of Asheville supplies his patients with small record books, in which they make daily note of the amount of time spent in the open air, the amount of nourishment taken, its character and time of ingestion, their temperature and pulse, and also their symptoms or subjective impressions—all very briefly. This stimulates an interest or ambition to carry out regulations to the letter and present as favorable a report as possible. In general, it is a good plan to follow; in certain cases, however, particularly those inclined to be slightly morbid or neurasthenic, there is the danger of fostering a somewhat unhealthy introspection. Though it is well that these patients

should understand the principles and the object of their treatment, and their true condition as well, in order that they may appreciate the importance of the regulations and measures, and may co-operate enthusiastically in carrying them out. This is half the battle. A patient who is bright, enthusiastic, fighting to get well, brave in carrying out the treatment to the letter, will surely recover if there is one chance of recovery left. It is this element, among others, which makes the question of treatment, and the personality of the physician, of so much greater importance than change of climate.

After the temperature has become normal and the heart regular and not very rapid, exercise should be instituted. No case can be considered cured or arrested unless he or she can return to an ordinarily active life and remain free from symptoms. In order to attain this end, exercise must be gradually and systematically increased. Begin by permitting a walk of five minutes a day. A short drive or sleigh ride is a good way of getting air and exercise. The temperature and pulse should be taken following the walk, and any significant increase in their rate should be a signal that they are not yet ready to go on in this direction. If temperature and pulse are not unduly affected, the time of exercise should be gradually increased by the watch. In this way the amount of exercise may be increased until the patient is up and about, walking three or four hours a day,

and leading a practically normal routine—**all without significant loss in weight.**

If exercise gives rise to palpitation, dyspepsia, rise in temperature, headache, attacks of coughing, or vomiting, it should be discontinued. If it gives rise even to fatigue or a general feeling of discomfort it should be decreased. Patients should never exercise to the point of fatigue. If a patient is much below his normal weight he should not exercise.

Incipient cases or those even moderately advanced may be restored to good health, even when the above regulations as to rest cannot be fully carried out on account of the necessity of continuing at work. This makes the progress slower, less satisfactory both to the patient and the physician, and exposes the patient to unforeseen setbacks. But there is such a strong tendency for a tuberculous patient to recover, that in many cases, if caught early, the system, if given only half a chance, will react bravely. I have known, in this connection, shop girls and clerks, whose duties were not too confining, to recover much of their health, and in some cases to have the process arrested entirely, under this unsatisfactory and partial treatment. The improvement even in dispensary cases seen at the Phipps Institute, where patients are often ignorant and careless, and where from force of circumstances, measures cannot be thoroughly carried out, is simply remarkable. In private practice, even among patients of small

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means, the chances for recovery of a fair amount of health, or for the arrest of the disease are correspondingly increased. The tuberculosis enthusiast and expert is never discouraged because his patient cannot lead the ideal life, but the perseverance of the doctor and the close scrutiny of the patient's life and environment will soon lead the latter to better ways, will show him availabilities in his home, and opportunities for rest and treatment of which he never dreamed.

In certain cases running a low temperature (around 99.5°)—which is sometimes kept up by cardiac irritability, gastro-intestinal irritation or constipation—properly regulated exercise will result in an improvement in nutrition and the disappearance of the fever. Again, after a patient's nutrition and strength are improved, one may attack dyspnoea by suitable exercise, moderate, gradual inclines, directed to strengthening a dilated heart. In general, however, unless one is very familiar with this disease, it is safest to keep a patient at rest until the fever is practically normal, and dyspnoea and rapid pulse have abated.

In conclusion, then, all cases of tuberculosis are preferably treated out of doors. This is not essential. A well-ventilated room can be made to answer. All patients with fever above 101° should be confined absolutely to bed. If temperature is between 100° and 101° the patient may be permitted to be dressed but must lie recumbent on a lounge or cot—preferably in the open air. When

the temperature is consistently under 100° or around 99.5°, eight to ten hours should be spent in a reclining chair out of doors—but protected from very high winds or hot sun.

Exercise should be instituted when the patient's temperature and pulse are normal, and should be slowly and systematically increased if he is not adversely affected by it. The final aim must be to fit the patient for the strain and activity of a normal but guarded life.

A word in regard to calisthenics or exercise directed to the development of the chest and the inflation of the lungs. These are, in my opinion, distinctly dangerous and to be avoided, particularly in the active stages of the tuberculous process. It is doubtful whether the increase in the pulmonary circulation thus brought about does not increase the absorption of proteins and impede the formation of a zone of demarcation, as thought by Cornet and others. Furthermore, it may lead to the extension of the tuberculous infiltration by the aspiration of bacilli into previously healthy lung tissue. I have seen it produce hemorrhage; and it has seemed possible that the number of cases of pneumothorax developing in patients treated with "setting up" exercises by Major Appel at Fort Bayard, may have been directly due to the increased intrapulmonary tension thus brought about. Chest exercises and deep breathing are good for the growing child or for those with faulty chest development, but with-

out localization of the tuberculous process in the lung. The strongest indication, in my judgment, even after arrest of the tuberculous process in the lung, is for relative rest of the diseased organ. Dettweiler, Brehmer, Cornet, Volland, Liebermeister and other European authorities insist on the dangers of pulmonary gymnastics.

On the contrary, Minor of Asheville strongly advises "setting up" exercises, deep breathing, exercise with light Indian clubs and even the parallel bars, in properly selected cases.

S. A. Knopf believes that he has seen "the best results follow judicious, careful graduated breathing exercises in a very great number of tuberculous patients," but says that irreparable harm may be done by their injudicious application. Under no circumstances should they be left to the judgment of the patient, and the cases and form of exercise should be carefully selected.

A patient in a highly febrile state, or during an acute exacerbation of the tuberculous process, or an active hæmorrhage, should refrain from all respiratory exercises. Following a hæmoptysis all respiratory exercises with movements of arms should be prohibited, at least for a time. On the other hand I encourage quiet and deep respiratory movements, a few at a time, following a hæmoptysis. In cases where the sanguine expectoration has continued for weeks these deep, quiet respirations seem to have acted as a veritable styptic. Irritating cough resulting from the attempt to carry out the breathing exercises, or pleuritic pains resulting from the tearing of old adhesions, are no contraindications to the continuation of the respiratory exercises. Both cough and pain will

cease in a short time. As long as the patient has learned to breathe properly through the nose and the air is relatively pure; cold, warmth, rain, snow and even wind should not prevent the patient from carrying out the physician's instructions for breathing exercises.

I cannot agree with this, and at the very farthest would say that in arrested cases, where the process has been walled off and where there is no cough nor other symptom, and the patient is vigorous and robust, light arm exercises without dumb-bells or clubs, and slow, deep inspiratory movements may be practiced without danger and with apparent benefit.

Massage, while less dangerous, must be practiced with caution, particularly as it is applicable at an earlier stage, before the patient is fully restored to health. Where patients have put on much weight and are fleshy, massage practiced carefully and in moderation, applied to limbs and abdomen (not to the chest), when unattended by fatigue or other evidence of ill effect, serves to occupy them and to improve their nutrition.

When a patient is improving steadily and gaining weight, and is confined to bed, alcohol baths, or careful sponging, with gentle massage, serves a useful purpose in equalizing circulation and helping nutrition. Even mild resistance exercises, if the patient's condition warrants it, and if carefully given, are often most useful in toning up the heart and assisting metabolic processes. Such measures are really part of the duties of a well-

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trained nurse. As a rule these exercises brighten the patient both mentally and physically. Should they cause dyspnœa or cough, or increase unduly the fever, they should be given up.

Massage is particularly applicable to the lower limbs after the patient has gained well in weight, in preparing him to walk. Much the same may be said of electricity. Binswanger advocates faradization with an electrical massage roller for half an hour once or twice a day in combination with the Weir Mitchell rest cure.

Inhalations of compressed air in pneumatic cabinets, of rarified or dry hot air, have no effect on the tuberculous process and should never be used, unless the disease is stationary or chronic. Where there is chronic congestion of the bronchial mucosa and severe chronic bronchitis or asthma, they may serve to influence favorably these latter conditions.

CHAPTER III.

CLIMATE.

THE question of change of climate, implying as it necessarily does a considerable and continued expense, the severance of a patient from home comforts and family ties, is a serious one and should be discussed plainly in its varying aspects, both for the benefit of the general practitioner, whose views are too often quite erroneous in this matter, and also for the education of the laity. Tuberculosis being essentially a disease of the poor, or at least attacking so frequently those of limited means, the theoretical advantages to be gained by change of climate must always be weighed in the balance with the practical aspect of the case in relation to financial resources and the availability of treatment at home. Expert care and treatment of these cases is of much greater importance than change of climate. It is true that if a patient can afford to go to a suitable health resort and there have proper care and treatment, it is a distinct advantage. But outside of sanatorium treatment, which is admittedly the best, this is often impossible.

As insisted upon by Walsh of Philadelphia, Jacobi of New York, and others, these cases can be treated most successfully right in the heart of a great city, and the former authority goes so far

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as to say that a case of consumption which cannot be cured at home cannot be cured anywhere. Flick of Philadelphia was one of the earliest, if not the first to recognize this. He says that as tuberculosis is a disease of the home, running its course in the home, proving fatal in the home, it is too prevalent to be treated except in the home.

He well presents his point of view in a recent paper¹ and concludes: "In my judgment the treatment of tuberculosis can be better carried on at present in the home of the patient, in those places at least where expert services can be given, than in a health resort. For people living in places where expert services cannot be had, it is undoubtedly better to go to a health resort than to remain at home."

Certainly one cannot condemn too strongly the advice so commonly given, founded on false conceptions, ignorance, and irresponsibility—to go away, live out of doors, take plenty of milk and eggs, and not "overdo" exercise. Those who follow such unfortunate and reprehensible advice, and there are many thousands who do, are victims to the ignorance of the profession, and are hourly frittering away their chances of recovery.

The fact remains, however, that other things being equal, change of climate aids materially recovery. This results from its vitalizing effect on the whole system. The increase of appetite,

¹The Relative Value of the Home Treatment of Tuberculosis. Am. Journ. of the Med. Sciences, Oct. 1906.

the stimulation of metabolic processes, the tonic effect on the nervous and cardio-vascular systems, the change of mental attitude, the stimulation of hope, are some of the ways in which it does good. Catarrhal inflammations are less prevalent in a dry, sunny climate free from dust, and the increased vigor of the patient enables him to resist them or to throw them off, hence the dangers of mixed infection are appreciably less. But in order that good effects should be achieved, the patient's financial circumstances must be fully adequate to surround him with comfort, and above all to supply the care and treatment absolutely essential to the proper progress of his cure.

As well said by Minor of Asheville:

If one has to choose between treating patients in narrow circumstances in their own homes or sending them to a resort where their poverty will not enable them to get the necessary conditions of quarters, diet and care, which are so essential, by all means let them stay at home. By changing their houses, by moving to the top floor, using the roof as an outdoor sun-parlor, and spending the utmost part of their time there, by economizing in every other way in order to be able to spend more freely for good food and cookery, much can be done, provided always that their lives can be properly supervised. When pecuniary reasons prevent the patient from seeking a special climate, excellent results can thus be had, though with greater difficulty, in the patient's home, if the case is not too advanced and that home not too miserable.

But to quote from the "report of the committee on the influence of climate in pulmonary tubercu-

losis" appointed by the National Association for the study and prevention of tuberculosis:¹

Both in hopeless and hopeful cases the clinical evidence is too conclusive to admit doubt of the power of these more or less unclassifiable influences (of change of climate). In advanced cases the great amelioration or cessation of many of the most painful symptoms and the general improvement of the patient's comfort and strength, combined with the marked effect on mixed infections, cannot be doubted. They far surpass the very best results [this is perhaps too strong a statement] obtainable in similar advanced cases in our cities on porches or roof gardens, and the rapid relapses which in such advanced cases follow their return to ordinary climate are only another testimony in the same direction. Often, indeed, cases which on arrival appear to be utterly hopeless, patients who are brought on stretchers in the most desperate condition and whose course in their homes had been steadily downward [perhaps owing to want of proper treatment], will against one's best anticipations, rally and regain a very fair state of health, which often can be continued for years provided they do not return to less favorable regions.

But it is hard to differentiate between the good resulting from the proper care and treatment under the above circumstances, and that directly attributable to the effect of climate. As the treatment of this disease is becoming better understood and its wonderful results appreciated, the factor of climate is recognized as being of less importance than was formerly supposed. To quote Norris of Philadelphia on this point:

The good results of sanatorium treatment are due less to the climatic causes, and more to the careful and constant

¹The Medical News, Nov. 11, 1905.

supervision of the minor details which go to make up the daily regimen than is generally supposed. A patient with limited means would far better remain in a crowded city if he can command home care and comforts and a proper dietary than move to some health resort where, owing to his lack of funds, these items will be grudgingly and inadequately supplied.

The choice of a particular climate or health resort must depend not only upon the condition of the lungs but also upon the general condition of the patient. "It is possible to select a climate on wrong principles; that is, in being too much influenced by minor features of patient or location, which while of some importance, are still essentially irrelevant to the purpose." (C. T. Williams.) It is after all the fresh air and rest which we want rather than some fancied superiority of a particular spot. In general, it may be said that cases of pulmonary tuberculosis do best in a dry, equable climate, of moderate altitude. Dryness; purity of air; freedom from dust, from high winds, from sudden changes of temperature; a maximum amount of sunshine and a minimum amount of humidity, dampness or bad weather—seem to be the most important elements. No climate is specific, but that which allows the patient to spend most time out of doors with the least discomfort is, generally speaking, the best. The higher the altitude, the more rarified the air, while of advantage in certain cases, the greater is the demand made upon the strength and resistance of the patient. The climate must be selected

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for each particular case, speaking theoretically, according to its incipency and general condition.

In dry, warm climates of moderate altitude the diminution in the cough and expectoration is sometimes very marked. Catarrhal conditions are relieved, so that such a climate is helpful where there is a tendency to bronchial or nasopharyngeal catarrh. Such climates have an excellent effect on the walls of cavities and there follows a change in the character and a reduction in the amount of expectoration—provided always the patient's general condition is sufficiently robust for him to bear the altitude and change. Feeble catarrhal patients should not of choice be placed in the open air in damp, cold climates, which tend naturally to increase catarrhal symptoms.

Perhaps the most important point in a contemplated change of residence is the proper preparation of the patient. It may take weeks or even months to put him in proper trim, but fever and acute symptoms should be relieved before permitting his departure. A patient's condition should be gotten to, one might say, a standard, before sending him away. As a general rule to follow, it is not wise to send patients away until they are fairly on the road to cure. High fever and rapid pulse contraindicate a change. Such patients should be first put to bed at home, and under systematic treatment, the temperature and pulse reduced, acute pneumonic infiltration relieved, the general nutrition improved, before

sending to a health resort. Blood spitting is not in itself a contraindication to change, provided always the condition of the patient is good and the cause of the bleeding understood. Bleeding in tuberculosis arises from a variety of causes, as will be outlined later, and is by no means always a serious symptom. Frank hemorrhage from eroded vessels in cavities should certainly contraindicate immediate change of residence.

As a rule, indeed, routinely, it is best to carry the patient as far along on the road to health as seems possible (within certain limits) by treatment at home,—at least to relieve all symptoms so far as may be,—and to make use of change of climate to complete the cure. After comparative quiescence of the lung process has been reached under home treatment, and the nutrition is much improved, there comes a stage when further improvement is slow. This is the psychological moment for change. Indeed it is well to bring a patient approximately to that point in his cure where he is ready to begin exercise, before sending him away.

After reaching his new residence, even under these circumstances, he must continue to rest for a considerable period. It is a serious mistake, often made under the stimulating and invigorating effect of the change and new atmosphere, for patients to take too much exercise, and in the first week undo the work of months. The first flush of the change as manifested in renewed vitality is

lost, and they often do their condition incalculable harm; indeed, may change a favorable case to an unfavorable one. On arriving in a new atmosphere they should go to bed, or at least take a maximum amount of rest for the first week or two, until their system becomes acclimated to the change, and should only begin to exercise with the greatest caution and under skilled medical supervision.

In general it may be said that the more incipient the lesion, and the better the nutrition and health, the greater may be the change,—*i.e.*, the higher the altitude and the more rarified the air. Very great altitudes are not necessary nor advisable. “The higher, colder altitudes are suitable only for persons of robust constitution apart from their local process; or for those whose organs of nutrition and oxidation are sufficiently sound functionally to do much more work than they have been accustomed to at home.” (Huggard.) Incipient cases, or even those moderately advanced, but without much softening or breaking down of lung tissue, do well if the cardio-vascular and nervous systems warrant it, at altitudes of four, five or even six thousand feet, as for instance in Colorado, Arizona, or New Mexico. In Colorado the altitudes are, at Pueblo (4700 feet), Glenwood Springs (5200), Canon City (5300), Denver (5300), Colorado Springs (6000). In New Mexico, at Fort Bayard (4450), Albuquerque (5000), Silver City (5800), Las Vegas (6700), Santa Fe (7000). In

Arizona, at Flagstaff (7000), Prescott (5300), Castle Creek (2800).

In these places the air is rarified and very dry, and there is much sunshine. Sometimes the temperature becomes high in summer but it is a very dry heat and rarely oppressive. The evenings and nights are always cool on account of the air blowing from the mountains. The effect is invigorating and tonic, not sedative. The appetite is increased and metabolic processes are more active. The nervous and cardio-vascular systems are stimulated. The rarification of the air and the altitude causes the heart to beat faster and the lungs to inspire more deeply. The patient even while resting is taking more exercise than at lower levels. Consequently in going about, more is demanded of heart and lungs, and this increased work is in suitable cases most salutary.

On the other hand these altitudes are not suitable for cases with active processes, much softening or breaking down of lung tissue, or productive cavities. Cases with laryngeal or intestinal involvement, with emphysema, with renal or organic heart disease, with diabetes or marked anemia, should not be sent to high altitudes.

As a rule, at lower levels there is less variation between day and evening temperature, and the winds are apt to be milder. There is also not the dryness of atmosphere. Many health resorts in the East are at these lower levels, under 3,000 feet; and are situated in the mountains, near lakes or

streams or other bodies of water which render the atmosphere soft and equable yet without great humidity; while the presence of pine forests protect from high winds and give an invigorating spice or balm to the air. They are thus less stimulating to the heart and nervous system and cutaneous functions. Nor is the appetite so good, nor the metabolic processes so active. The effect is more sedative and less work or strain is put upon the organism. These lower levels are not less valuable because less stimulating, as less strain is put on the patient's strength, and hence cases whose general condition would not warrant an altitude will do well here. Patients with moderate fever and rapid pulse (if not treated at home first as recommended), but without evidence of marked cardiac or renal involvement and without pronounced nervous symptoms, will do well at any of our Eastern health resorts, of which the best known are Saranac Lake, N. Y. (1600 feet), Lake Placid, N. Y. (1860), Sharon Springs, N. Y. (1350), Bethlehem, White Mountains (1459), Rangely Lakes, Me. (1511), White Haven, Pa. (1300), Asheville, N. C. (2225), or Redlands, Cal. (1350), Yuma, Arizona (1400).

More advanced cases with higher temperature and impairment of cardio-vascular system, with evidences of toxic myocarditis and arteriosclerosis, with vaso-motor and muscular weakness, with much loss of weight and anemia, or evidences of renal or intestinal involvement, are best treated

at very moderate altitudes. This is true for practically all advanced cases where evidence of resistance to the disease in fibroid change in lungs and pleura has not taken place. Such cases are preferably, as has been insisted upon above, treated at home until such time as they are fit for a change. But under the favorable circumstances of ample financial resources and the availability of expert medical attendance, there is every reason why they should be given the advantage of any change which may prove, however slight, a factor in the treatment. Places coming under this class are, in California, Los Angeles (330), Pasadena (900), Riverside (850), Aiken, S. C. (550), Camden, S. C. (200), Lakewood, N. J. (100), Thomasville, Ga. (300), Augusta, Ga. (150), Sharon, Mass. (350), San Antonio, Texas (350), Phoenix, Arizona (1100), Moosehead Lake, Me. (1000).

The seacoast is not as a rule a good place for the residence of tuberculosis cases, because there is usually much moisture in the air, and it is often damp or foggy. In summer, too, it is apt to be hot and depressing. The climate of seaside resorts is sedative, and while the increased amount of ozone in the air has been considered theoretically of advantage, other factors would seem to counterbalance the good effects from this source, granting that this were so. Patients as a rule sleep well in such a climate, and the least amount of strain is put upon the heart, blood-vessels and nervous system. The appetite is not stimulated and

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patients often suffer from anorexia, and the effects of sluggish metabolism. The cooler and more bracing the air, however, the less this is true. Mount Desert Island and some of the New England seacoast resorts should be mentioned as being more tonic and invigorating than places farther south, as for instance, along the New Jersey or Florida coasts. The coast of California has certain advantages over our eastern shores as the atmosphere is dryer and there is more continual sunshine. Resorts along the western coast are Monterey, Santa Barbara, Coronado Beach, San Diego. One can live out of doors in all of these places, and I found a few consumptives living in tents under ideal surroundings of food and climate, albeit with these reservations as to its sedative and relaxing effects, at Catalina Island, California. This small island just off the mainland is protected from high winds and fogs by a forest-covered mountain extending its entire length, and the climate is always temperate, clear and balmy, and the people bathe in the ocean all the year round. But sea bathing is not of course available for consumptives, except in arrested cases and even then with caution, while the walks in Santa Catalina, except the short stretch of level beach bounding the pretty cove, are rough and declivitous.

A sea voyage is sometimes prescribed. This might on the face of it, seem an ideal way of getting plenty of rest and ozone. It is, in my judg-

ment, of doubtful value on account of the ever present danger of rough weather or stormy days, the monotony and relative poverty of the diet and cooking, and the possibility of seasickness. It would only be suitable at best to incipient cases, and these are best treated elsewhere.

Finally it may be said that a good summer climate is not always a good winter climate, and that even after a certain climate has been selected with the greatest care it may not suit the idiosyncrasies of the particular patient.

For prolonged stay or a good winter climate, I should like to call especial attention to Silver City, New Mexico. Dr. C. B. Penrose, who has probably had more experience of the West in this regard than anyone equally qualified to judge, says:

I have spent a good deal of my life in the Rocky Mountain region from Old Mexico to British America and I think that Silver City and the immediate neighborhood offer more than any other place that I have found. The altitude is 6,000 feet, which is the best average for the consumptive. It is situated in the driest section of the United States—one of the driest parts of the world. There is almost continuous sunshine. A few years ago there was only one cloudy day during a period of six months. It is so dry that precipitation of dew or frost is rare. Although the altitude is 6,000 feet there are no large mountains near it. This I consider a distinct advantage, as a large mountain range like Pike's Peak in Colorado Springs shuts off the sun early on the winter's afternoons and attracts storms. The United States Government after investigating numerous localities for the establishment of a sanatorium for consumption selected Fort Bayard, which is eight miles from Silver City, as offering the most favorable conditions.

" It is difficult to draw minute and precise conclusions as to the suitability of different places from the results obtained in individual cases " (Burney Yeo). Sometimes intelligent patients by moving from one place to another, always with the primary view of being under expert medical care, may hit upon a place which suits them perfectly. Or again, starting at lower levels as their condition improves, they may gradually seek higher altitudes. However, it is infinitely preferable for the one doctor to have the case which he has gotten to know and understand, under his continual observation, and a patient having gone to some health resort or sanatorium should stay there three, six or twelve months, or longer, until his cure is completed or the disease satisfactorily arrested. The length of time necessary for the arrest or cure of a case cannot be presaged. It may under the most favorable circumstances in incipient cases require only three months, but varying with the prognostic factors it may require three years or even more. Some cases can never return to their former climate, or perhaps it had better be said, home surroundings, without a recrudescence of their disease—as a rule due to other factors rather than climate. The term "arrested" is a better one than "cured," as even if the process is walled off by connective tissue and dry, and the patient free from symptoms, there is always the danger of subsequent acute infection or exposure or carelessness on the part of the

patient, lighting up the old focus. This is not meant to mean that many cases of tuberculosis are not absolutely cured, for they are; but the proof of cure lies only in the subsequent course of the patient's life.

Without attempting to dogmatize upon the question of climate, one important fact stands out, *i.e.*, the sooner the general practitioner or internist ceases to advise change of climate promiscuously, the better it will be for consumptives in general and for those of small means in particular. Too often the physician out of thoughtlessness or from habit, advises a change of climate to those who can ill afford it, or who are not really proper cases from a medical point of view to send away. Poor people often make a financial effort and pay one visit to some well known physician for an opinion or diagnosis. The latter finds them suffering with tuberculosis, usually well advanced, and with self-complacent irresponsibility advises them to "go out West." He may even go so far as to tell them that in this course lies their only chance of getting well. Such advice cannot be too strongly condemned, both from a professional and humanitarian standpoint.

But the fact remains, I believe, that change of climate in suitable cases, and in those properly prepared by treatment at home, is of distinct advantage, provided always that the patient's financial resources are amply adequate.

CHAPTER IV.

DIET.

THE feeding of tuberculous patients is most important. It must conform to the requirements of the stage of the disease, and it may almost be said that the amount of toxemia and tissue destruction bears a direct relation to the necessity for increased nourishment; and that no particular kind of food, with the possible exception of milk and eggs, should be used to the exclusion of others. That diet is best which furnishes the greatest amount of nourishment and which is most easily assimilated; and this will, within certain limits, vary according to individual habit and taste. Milk alone of all foods contains in itself the nutritive elements of a general diet, and at the same time puts as little strain as possible on the gastrointestinal tract.

In incipient cases, or those in what has been somewhat paradoxically termed the pretuberculous stage (which really means the pre-symptomatic stage, *i.e.*, before mixed infection has taken place), there is no better diet than three good general meals a day, plus a little milk drinking. This in connection, of course, with fresh air and rest. A glass or two of rich milk between breakfast and dinner, the same between dinner and supper, and

again before retiring (early) will amply suffice in the way of feeding.

More advanced cases, with loss of weight, require more nourishment, and it must be more assimilable than solid food in order not to upset the digestion, and so we turn to milk and eggs. The principle involved is that of getting as much nutritive value out of the diet with as little strain on the gastro-intestinal tract as possible. The welfare of the latter must be jealously guarded. There are other types of food more fattening than milk and eggs, but none which fulfil so well the general indications in furnishing an equal amount of nourishment, an equal variety of nutritive elements, in being so easily digested, and in leaving so small a residue for the intestine to handle. Milk and eggs are the essential part of the diet when a "diet" is called for, and under no circumstances, or only the most exceptional, should they be omitted.

Many patients have an apparently insufferable objection to one or both, but this should not be yielded to, and under proper explanation of their value and the absolute necessity for their use, and with the proper method and time of administration, this difficulty is usually readily, but should at any rate, eventually and unfailingly be overcome. "Patients will better appreciate the necessity for milk drinking if it is explained to them that one glass of good milk contains as much nutritive material as two eggs, three ounces of

lean meat, sixteen ounces of oysters, one ounce of cocoa or cheese, or two ounces of bread." (Norris.)

The difficulty patients have in taking milk and eggs lies too often in the doctor's desire to have them take solid food as well. Their want of appetite, or impaired digestive power, often makes this impossible at first. I have often seen patients who could not take milk and eggs and one solid meal a day. But in my own experience, I have known of very few cases in which, beginning if necessary by the omission of all solid food, it was not possible for the digestion to assimilate perfectly milk and eggs. The mental aspect of this question, when it is a factor in a distaste for this diet, must be dealt with too. I have known cases so opposed to this diet that they have left their family physician because he insisted upon their taking milk and eggs, only to fall into the hands of a specialist in this disease, and, under expert control, beginning with one glass three times a day (in one case, with a tablespoonful three times a day), to end after a month or two of persistent effort by taking the regulation three quarts—and be proud of it!

I take pleasure in recording the particular instance of the tablespoonful three times a day, because it serves to emphasize the persistent and painstaking care, the stimulation of the patient's co-operation and will power, so necessary in this disease; and to reiterate that any physician can treat tuberculosis successfully in any climate, pro-

vided always he possess the necessary knowledge and experience, and the necessary personality.

As a routine practice, in cases with much loss of weight, it is well to start out at once with two quarts of pure, rich milk and four fresh eggs a day. Later, as the facility to take nourishment and the appetite improves, this amount should be increased to three quarts and six eggs a day. This latter is a good general average, particularly in cases where there has been much loss of weight. In following a regimen the exact time and amounts should be strictly adhered to. The day should be begun early, and this will naturally be the case if the patient is sleeping out of doors. He should at any rate be awakened in time to begin taking nourishment at 7 A.M. At this hour two glasses of milk and two eggs are taken, with toast and butter, cereal and fruit; at 10 A.M., two glasses of milk with crackers, or bread and butter or toast are taken. At 1 o'clock, *lunch*, the one regular meal of the day, consisting of plain, wholesome food, properly cooked and daintily served, like fresh meats, game or fish; the starchy vegetables like potatoes, beets, rice; the green vegetables like spinach, beans, peas; plenty of bread and butter, and a cup or two of cocoa, chocolate or weak tea. For dessert, simple puddings like cornstarch, tapioca, junket, rice, custard, bread pudding; baked apples or stewed fruit. Fresh fruit if not very acid may also be allowed, like oranges, peaches and pears. At 4 P.M., two glasses of milk

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with crackers, etc. At 7 P.M., two glasses of milk and two eggs, with bread and butter and jam. At 8.30 P.M., bed and sleep. (The above diet includes two quarts of milk and four eggs.) If the patient cannot take this amount, cut out the midday meal and substitute a pint of milk and one or two eggs.

The superintendent of Sunnyrest Sanatorium at White Haven, Stockdale, gives the following dietary for that institution:

8 A. M. Breakfast. Fruits, cereals, one raw egg, three glasses of milk, coffee, toast.
10 A. M. Two raw eggs, two glasses of milk, crackers, pretzels.
12.30 P. M. Dinner. See menu below.
4 P. M. Two raw eggs, two glasses of milk, crackers, pretzels.
6.30 P. M. Supper. One raw egg, three glasses of milk, tea, toast, fruit.
8.30 P. M. Two glasses of milk.
Summary. Six raw eggs, three quarts of milk and one full meal.

The following are two sample dinners (midday meal) in association with the above:

Purée of peas.		
Breast Spring Lamb.	Mint Sauce.	
Prime Ribs of Beef.		
Boiled White Potatoes.	Baked Sweet Potatoes.	
Spinach.	Stewed Tomatoes.	
Lettuce Salad.		
Baked Apples.	Cup Custard.	
Crackers.	Cheese.	Nuts
Coffee (<i>demi-tasse</i>).		

Cream of Tomatoes.		
Broiled Sirloin Steak.		
Stewed Chicken.		
Boiled White Potatoes.	Stewed Onions.	String Beans.
Steamed Rice.		Macaroni.
	Salad.	
Apple Tapioca.		Rice Pudding.
Crackers.	Cheese.	Nuts.
	Coffee.	

It should go without saying that the "food" should be carefully masticated and thoroughly insalivated. This applies to a less extent to the milk, which should be taken slowly. Eggs are preferably swallowed whole, and not beaten up in the milk. An egg is broken into a small glass and sufficient milk added to cover it only. The patient can soon get to tossing this off without difficulty, and in this way the taste of the egg is entirely avoided. The rest of the milk due at that period should be taken slowly and "almost chewed."

Butter is very fattening and has a high caloric value. It is well for tuberculous patients to partake freely of this, provided always that it does not upset their digestion.

The question of how far to force food is influenced so much by the individual's gastronomic ability and the condition of his digestion, that every case must within certain limits be a law unto itself. But I hold with those who believe in pushing nourishment (within reasonable limits) as far as can be done without danger of upsetting the digestion. It must be remembered that a patient

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suffering with tuberculosis needs more food and can assimilate more, paradoxical as it may at first seem, than can a healthy person. Nothing is accomplished, however, and indeed much may be lost, by even temporarily placing too great a burden on the digestive system. The greatest care must be exercised in guarding against this, but like the bugbear of fresh air giving rise to "colds," ordinary standards must be disregarded, as practical experience has shown that these cases thrive best on large amounts of suitable nourishment. It is not surprising that this should be so when we take into account the enormous destruction of body tissue produced by the disease. The most noticeable effect of consumption is the progressive emaciation. "Our first aim must be to stay the increased metabolism, to make good the pressing deficit, and by a heightened nutrition to cover the loss which has already occurred." (Cornet.)

When the patient has been naturally a large eater, or where the appetite will permit, a light breakfast and supper may be added to the above dietary. It should be noted that the appetite of tuberculous patients improves with the improvement of their condition, and that both appetite and digestion show a marked stimulation from the improved hygiene. One of the most salutary effects of the rest and fresh air is an improvement in the ability to take and digest food. It is important, if a patient is going about, that he should rest

before and after meals. This applies particularly to the midday meal. He should lie down for half an hour before and should rest or nap an hour afterward. A half-hour's rest should also be taken before supper.

The following may be suggested as a full dietary, suitable for patients with large appetites and good digestion, or for convalescent cases. Naturally small eaters could not follow this, without modification.

7 A. M. One pint of milk and two raw eggs, taken in bed.

8.30-9 A. M. Breakfast. Fresh fruit, cereal, bacon, salmon, herring, or tender steak, chop or chicken; dry toast, wheat bread or corn bread; a pint of milk or cup of coffee, chocolate or cocoa.

10 A. M. One pint of milk and one raw egg.

12.30-1 P. M. Lunch (heaviest meal), preceded by half-hour's rest. Thick soups—purée of vegetables, especially the albuminous legumes; a roast and vegetables; bread with plenty of fresh butter; simple desserts with sugar; beer, ale or claret in moderation; a demi-tasse and one cigar. Rest or nap of one hour.

4 P. M. One pint of milk and one raw egg.

6 P. M. Supper, preceded by half-hour's rest. Light, simple meal, cold meats, light salads, tongue, sardines, etc. Pint of milk, or cup of weak tea, or cocoa.

9 P. M. One pint of milk and two raw eggs.

9.30-10 P. M. Bed.

The eggs of course should be unequivocally fresh. Care should be exercised in the choice of milk, as when contaminated by a high bacterial count, it often gives rise to gastro-intestinal dis-

turbance and diarrhea. It should be fresh, rich and from healthy cows. If desired a pint of cream may be added to two and a half quarts of whole milk to make the daily three-quart mixture richer in fat. Much of the objection to milk on the part of patients is due to impurity and to want of cleanliness and daintiness in serving. It should not be allowed to stand in the bedroom, nor served in a glass unwashed since last milk-taking period. It should not be boiled, sterilized, nor even pasteurized, but when possible "certified" milk should be secured which has a bacteria count of less than 10,000 bacteria to the c.c. as against 200,000 to 500,000 per c.c. in ordinary milk or milk taken from the cow and shipped cityward without the precaution of the utmost cleanliness.

The idea, so prevalent, that large quantities of milk give rise to "biliousness" or constipation is erroneous and founded on ignorance. In small amounts milk is constipating, but in the amounts instanced above it is distinctly laxative in its effect and serves to keep the bowels regular on account of its fat-content and the amount of fluid ingested. It is usual for patients to remark that their bowels have never been so regular before; indeed it does away, to a great extent, with the bugbear of constipation.

All foods which do not nourish should be sedulously avoided. Under this caption come the so-called indigestible foods, the canned foods, the fried foods, pastry, candy, and rich dishes of all

kinds, or any article of diet against which the patient may have an idiosyncrasy—always excepting milk and eggs.

The use of lettuce salad with plenty of French dressing is commended by some, for the sake of the olive oil; while oily nuts are also advised. If these articles agree with the individual patient, there is no reason why they should not be allowed.

Alcohol, for a long time a staple article in the diet of tuberculous patients, is now comparatively little used. The position of alcohol in the treatment of tuberculosis is, in my judgment, by no means settled, except so far as its general and indiscriminate use is concerned. In small amounts and in suitable cases I believe it to be a reliable general tonic and a stimulant to the gastro-intestinal function. In large amounts it has quite the contrary effect, and if used at all must be used with wisdom. It may be prescribed in the form of beer or claret once a day, as outlined in the dietary for convalescent cases. Whiskey, however, certainly has a place, not yet fully understood, in the treatment of these cases. We cannot ignore the empiricism which eventually lead to its abuse. It would seem to be particularly indicated in those cases with dyspnea and faulty circulation, where a cardiac stimulant is called for. Besides stimulating the gastric function, it facilitates, in a measure, the absorption of fats. In moderate doses (for it should be looked upon and used as a drug rather than as a food) it stimulates the nervous

system, and in selected cases, a glass of beer or an eggnog taken at night may favorably influence nightsweats and sleeplessness. Though theoretically its effect on body temperature seems in doubt, it has been used with favorable results in those cases where, following more or less prolonged and high pyrexia, the temperature becomes persistently subnormal. (Minor.) In such cases its stimulant and tonic effect facilitates the return of health and strength.

It should never be used, as in former times, for any fancied specific action against tuberculosis, as it has none. So far have views changed on this question, that it is now considered a predisposing factor to the development of tuberculosis. It should not be used continually, but only when a definite indication exists for it, and then as a therapeutic agent pure and simple. It should not be prescribed for children.

Pure olive oil is used by some as an article of diet. I have used it in a few cases and have not been much impressed by its efficacy. Landis of Philadelphia gave it a thorough trying out under the most favorable conditions at the White Haven Sanatorium and reports unfavorably on its use. It is apt to upset the digestion, nor do patients seem to gain well upon it. It certainly cannot compare in this respect with milk. The principle to follow, as stated above, is to supply an ordinary healthy diet, plus milk and eggs. No one in health uses olive oil as an article of diet, except as

a salad dressing (and while recognizing that this argument is a flimsy one) it seems somewhat irrational to prescribe it for those whose digestion is not primarily of the best, and the conservation of whose appetite for food is of such importance.

Cod-liver oil shares with whiskey the obloquy of unskilful and over use. At the same time experience has shown that the ingestion of large amounts of fat are of great benefit in supplying energy to the wasted organism. The problem here is one of digestibility. The same is true of cream and butter. All three have a vastly higher equivalent in calories than milk. One hundred grams or 1 litre of cod-liver oil equals 930 calories, while the same amount of butter yields 756, and of cream 215 (Boas and Cornet). One litre of skimmed milk equals 67 calories. But milk besides being readily digested and assimilated, contains all the advantages of a mixed diet in the nutritional elements of albumen, fat, carbohydrates, salt and water.

Emulsification makes cod-liver oil more easily digested and assimilated, but it still remains to most people highly unpalatable. I have used cod-liver oil in chronic fibroid cases with good digestion, and as a temporary substitute for milk (following marked improvement in nutrition and digestion) when the latter after prolonged use had become distasteful.

Of the use of substitute preparations or special foods in this disease, as for instance a meat diet,

or the various extracts of fats, vegetables, or special milk preparations which are from time to time exploited (too often as "sure-cures"), I shall say nothing, because, in my judgment, they do not fulfil the requirements of a general and natural diet. I would not give space to the special merits claimed for them, unless for the purpose of damning with faint praise; nor can I forbear a note of warning against their use, in that valuable time and even life itself, may be lost in straying after false gods. There is no specific food, just as there is no specific drug and no specific climate, nor do we need nor want anything better in the way of diet than that which nature, unassisted by the facile ingenuity of man, has made available and familiar to everyone.

CHAPTER V.

KOCH'S TUBERCULIN.

WHEN Koch made his announcement of tuberculin in 1890, he claimed two properties for it. First its power to produce specific reactions in persons suffering from tuberculosis; and second, its curative value if administered over a sufficient period in suitable cases. He limited its therapeutic value to incipient or afebrile cases.

His announcement was followed by a period of unwise misuse of tuberculin, in which initial subcutaneous doses of one milligram were given in advanced and unsuitable cases, producing marked local and general reactions and fatal extension of the disease. Stormy reactions were at first disregarded or at least misinterpreted, and were not considered contraindications to its use, nor to the doses employed, but even as symptoms of cure. This period of reckless experimentation was followed by a widespread and vigorous protest against the new remedy.

With greater experience, however, and the proper limitation of its use in regard to dose and method of administration, tuberculin has come to be very generally recognized as a remedy of great possible value; for even yet its use can hardly be said to be beyond the experimental stage.

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In 1901 Koch laid down the following rules for its application :

1. Only patients that have no fever and in whom the process has not advanced too far, are suitable for treatment.
2. One begins with a very small dose and increases it so slowly that only very slight reactions or even none at all take place.
3. If reactions take place tuberculin must not be injected again until the temperature has been normal for one or several days.
4. The treatment with tuberculin must be repeated till, after an interval of three or four months, the capability of reaction is permanently extinct.

He recommends that the use of tuberculin be combined with the modern open-air treatment, and all other special measures available in tuberculosis.

It is claimed that tuberculin acts as a stimulant to cell proliferation in moderate doses, and that repeated larger doses give rise to connective-tissue formation not only locally about the tuberculous process in the lung but elsewhere. It is also claimed that dilatation of the blood-vessels and extravasation of blood about the tubercles follow its continued use, accompanied by an accumulation of leucocytes and the multiplication of connective tissue cells in the periphery. A general leucocytosis accompanies the fever reaction in rabbits (Kinghorn). Degeneration of kidney epithelium, inflammation of the glomeruli and fatty degenera-

tion of liver cells followed by fibrous changes, may follow larger doses when given intravenously in animals. The many researches that have been made both in healthy and tuberculous animals indicate that the effect of tuberculin is in the main identical with that of the toxin produced or set free during the progress of the disease itself (Cornet).

There are many interesting theories of its action, the most recent explanation of Behring resembles somewhat the earlier explanations of Babes and Proca. Owing to the discovery of agglutination or precipitation phenomena in tuberculous blood-serum, he thinks that the smallest arterioles near the tubercles secrete antibodies or precipitins, thus causing intravascular coagulation by encountering the toxin as soon as the antibodies appear. This leads to the extravasations and other phenomena. The general reaction is less specific and due to free toxin.

As Cornet says—"it is clear from Behring's explanation why the local and general reactions gradually lessen and disappear under increased dosage of tuberculin if we assume that with repeated injections many cells other than those immediately surrounding the tubercle acquire the power to secrete specific precipitins. The toxin injected is thus bound elsewhere and prevented from exerting a direct influence on the tubercle tissue. In favor of this explanation is the gradual return of the tuberculin reaction susceptibility

after the cessation of injections and the accompanying decrease in precipitation power."

Pottenger¹ thinks that, among other ways in which it does good, is by raising the opsonic index of the blood (as established by Lawson and Stewart, Wright, Bullock and others). The opsonic power is a quality of the blood serum which renders the bacilli more subject to the phagocytic action of the leucocytes. This is in harmony with the observations of Behring, Koch, Moeller and others in regard to the increase of the agglutinating power of the blood after the administration of tuberculin. This increase in the agglutinating and opsonic power of the blood serum indicates an increase in the natural resistance of the body. In tuberculosis this agglutinating power, and the opsonic index of the blood, is low, considerably below that of the normal organism, as shown by the experiments of Lawson and Stewart, in which the leucocytes of patients treated by ordinary sanatorium methods were able to take up and destroy only 75 per cent. of the number of tubercle bacilli which a normal person's blood would destroy; while the leucocytes of the same patients after treatment with tuberculin were able to destroy 19 per cent. more than the leucocytes of a normal individual.

¹The Underlying Principles of Tuberculin Therapy. Med. Record, June 2, 1906.



FIG. 6.—Favorable site for tuberculin injection into tissues of subscapular region.

DIAGNOSTIC USE.

The characteristic reaction of an initial dose of tuberculin in a tuberculous subject is a rise of temperature, and this reaction has been made use of as a means of diagnosis. Its use for this purpose is harmless and of the greatest value in doubtful cases. Dr. Osler said, speaking before the British Congress of Tuberculosis in 1901, "In the wards of the Johns Hopkins Hospital we have used tuberculin very much as Professor Koch has advised, and I bear willing testimony to its inestimable value in certain cases, particularly in doubtful apex lesions, in obscure abdominal cases and in pleurisy. An important point is its harmlessness. I remember no cases in which injurious results have followed the injection."

Personally, I can say as much for my experience at the Phipps Institute. I have used it and found it of the greatest value in doubtful cases and have never seen any ill effects follow its use for purposes of diagnosis. The following is its method of application: The patient to be investigated is put to bed for twenty-four hours and his temperature and pulse rate taken every two hours for record. The following morning a hypodermic injection is made into the tissues of the breast or back, with antiseptic precautions, of one milligram of tuberculin. A solution is made in 5 per cent. carbolic acid, using Koch's old tuberculin or his new bacillen emulsion, so that 1 c.c. of the solu-

tion contains 1 mg. of tuberculin. Following this injection, temperature and pulse are taken as above. If no reaction follows in twenty-four hours, a second injection is given next morning of 3 c.c. of the solution, equaling 3 mg. of tuberculin. If no reaction follows this, a third injection of 5 c.c. is given on the following morning. The patient is kept in bed during the test and his temperature and pulse taken every two hours during the waking period. If no reaction follows this final injection, it is strong presumptive evidence that the patient is not tuberculous.

The carbolic acid solution should be freshly prepared and sterilized, and a fresh bottle, if Koch's old tuberculin is used, should be obtained every two weeks, as the glycerine preparation tends rapidly to deteriorate. It should be kept in a cool, dark place. The bacillen emulsion is a staple commodity, but the dilutions are more difficult to make. One c.c. of Koch's old tuberculin equals 5 milligrams of the solid substance, bacillen emulsion.

There is no danger in the test as outlined, even when incipient or latent tuberculosis is present, as the fever reaction is usually moderate and soon disappears if the patient is kept in bed a day or so. The advantage of making a diagnosis in doubtful cases before physical signs or symptoms are available, cannot be overestimated in relation to the prognosis of treatment.

Eric France published some interesting data, confirmed by autopsy,¹ which went to prove that the test was pathognomonic for tuberculosis. Since then Madison,² in an interesting paper, discusses fully this phase of the subject, and concludes as follows:

1. Patients may react to tuberculin and no evidence of tuberculosis be found at autopsy. [Very exceptionally.]
2. Completely healed tuberculosis may react.
3. Evidence is not conclusive that other diseases than tuberculosis may react to tuberculin. [Not yet confirmed by autopsy.]
4. The margin of error of the tuberculin test is considerable and probably not less than 10 per cent.
5. The maximum dose should be higher than 4 mg. and not more than 10 mg. Small increasing doses are not advisable as the reaction is not so likely to be distinct on account of the tolerance which may be produced. One initial dose of 3 to 5 mg. followed by the maximum is better.
6. The temperature should usually be normal before injections are given. When the temperature is distinctly above normal a negative result is of no value, as these patients will frequently not respond at all even to large doses.
7. It seems quite certain that the glycerine extract of tuberculin deteriorates and a fresh bottle should frequently be opened, care being taken to keep it in a cool, dark place. The 5 per cent. carbolic acid solution should be made up on the day it is used if possible. I believe that deterioration of tuberculin is the principal factor in producing delayed reactions.

THERAPEUTIC USE.

The use of tuberculin as a means to cure has

¹Transactions of the British Cong. of Tub., 1901.

²Am. Med., Dec. 20, 1902.

gained general recognition. There has always been the difficulty of differentiating between the amount of improvement due to this agent and to the other measures of hygiene, diet, etc., used in conjunction with it. It is impossible, of course, to make a strictly scientific and convincing test of its efficacy in a human subject by excluding other specific measures to a cure. We must, therefore, rely on the opinions of those who have had most experience with it and in whose unbiased judgment we have the greatest confidence. I had, therefore, almost proceeded at once to the opinion of Dr. Trudeau upon its therapeutic value. I will, however, let its distinguished originator speak first. Koch says:

I maintain that its efficacy as a cure is completely proved provided its application be restricted to still curable cases, *i. e.*, to those not too far advanced and not complicated by streptococci, staphylococci, pneumococci, influenza bacilli, etc. As these processes are almost always accompanied by rise of temperature, the best way of guarding against the misapplication of tuberculin is to use it in cases in which the temperature of the body does not exceed 37° C. That tuberculin exercises an exceedingly favorable influence on all such cases, and even completely cures them, as a rule, is a fact of which I have repeatedly convinced myself, and a number of other medical men, who have studied the therapeutic value of tuberculin for years and have either published their experience or communicated it to me privately, have arrived at the same result. As such I name Spengler, Turban, Petrusky, Krause, Thorner, Heron, Rembold, Bandelier, Goetsch, Kirchner, and Kartulis, to whose publications I beg to refer you.

It has been tested less generally and thoroughly

on this side of the Atlantic, but the claims of the great German seem likely to be eventually substantiated.

Pottenger of California, who has had considerable sanatorium experience with this agent, is enthusiastic in his endorsement of it. The reported cases in which it has been used have seemed to show that the cures are more permanent, and less subject to relapse than in cures unattended by its use. He claims this as an indication or test of its value. This is in accord with the views and experience of Trudeau, Brown, Van Ruck, Turban and others. Pottenger further claims that a manifest evidence of its value is seen in tuberculous laryngitis, where in lesser infiltrations (and even after ulceration has occurred) great improvement and even cure can be obtained in a large percentage of cases, by the continued use of tuberculin. He has reported fifteen cases so treated, in eleven of which the larynx cleared up entirely, and there was no further reaction to tuberculin.

Krause¹ has carried the use of tuberculin a step further and gives a course of it to out-patients with fever, where they are unable to avail themselves of sanatorium treatment. This is naturally an unfavorable class upon which to test the virtue of the remedy, yet he claims that benefit resulted in every instance. He used Koch's bacil-

¹Die Tuberkulin-Therapie in der ambulanten Behandlung und bei Fiebernden, Münchener Med. Woch., 1906.

len emulsion in a 1 per cent. dilution in salt solution, the dose ranging from .005 mg. to .03 mg. In the milder cases all the catarrhal manifestations disappeared, and they were always mitigated in the severer cases. The effect on the temperature and also the benefit in cases complicated by tuberculous laryngitis were not striking in his cases.

Van Ruck goes so far as to say: "I am ready to stand by the remedy not in recommending it as a cure-all, or under all conditions and manifestations of the disease, but certainly as a remedy of the greatest value when used in suitable cases and in a proper manner."

The experience of Dr. C. T. Williams (Brompton Hospital for Consumptives, England) and of Huggard of Davos, both recognized authorities, has been distinctly adverse to its use. Unfortunately the tendency in medicine is not to report unfavorable results, and so it is not possible to discuss this side of the question so thoroughly as the other.

But let us turn to one who can speak from a greater experience in the use of tuberculin than anyone else in this country and whose wide general experience in the treatment of tuberculosis gives his views and judgment additional weight and authority. Dr. Trudeau¹ says:

¹The Am. Journal of the Med. Sciences, 1906.

The best method has seemed to me to begin with very minute doses— $\frac{1}{10,000}$ or even $\frac{1}{20,000}$ of a milligram of solid substance Koch's Bacillen Emulsion, or a $\frac{1}{1,000}$ of a milligram of his old tuberculin, and increase so gradually at such intervals as to carry the patient to full doses with as little disturbance as possible; and by taking sufficient time, most patients can be taken through the entire treatment with but occasional and moderate reactions. At the slightest evidence of intolerance, as manifested not only by the patient's temperature, but by his symptoms, by marked irritation at the site of injection, or depreciation of his general condition, the intervals between the injections should be lengthened and the dose diminished for a time. Care should be taken never to inject after a reaction until all effects of the previous reaction, both on the patient's temperature and general condition, have entirely passed away. I have also formed the impression that the treatment should be extended over as long a time as is needed to avoid reactions, no matter how long that may be, and that time is an important element in obtaining the best results. Six months of treatment is almost always necessary, and a year or more would be better in many cases. The patient while taking the injections should show no depression of general health, and should have, except it be for the 48 hours following an increase of dose, no fever above his usual temperature range; if this occurs the treatment should be discontinued, and only resumed when he has recovered his normal condition. If full doses, that is 1 c.c. old tuberculin or 5 milligrams solid substance Bacillen Emulsion, can be reached without violent reactions and without depreciation of the general health (but not otherwise), the injections should continue until one full dose has been given; but the intervals should be lengthened gradually as the higher doses are reached and extended to two weeks between the last two or three injections. The physician must, of course, individualize, and be guided throughout the treatment, and in his judgment, as to the dosage to which it is to be carried,

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entirely by its effect on the patient; and on his watchfulness and skill will greatly depend the safety of the patient and the degree of success attained.

I quite agree with Denysz that the principal faults in treatment—faults which may lead to failure, and even seriously endanger the patient's chance of recovery—are:

“Beginning the treatment with too large amounts.

“Raising the dose too rapidly or at too short intervals.

“Injecting again before all effects of a reaction, both constitutional and local, have passed away.

“Increasing a dose after a reaction has occurred.

“Neglecting to consider malaise, headache, loss of appetite, and increased cough, as evidences that the limit of the patient's tolerance has been reached, and calls for an interval of rest and a reduction of the dose.”

Also that the physician who disregards as of no importance an increase of a minute fraction of a milligram of tuberculin, or a rise of a few tenths of a degree of temperature, will meet with disappointment and disaster in the application of the tuberculin treatment. I have become convinced that any danger there may be of aggravating the patient's condition by tuberculin treatment lies principally, if not wholly, in its faulty or reckless administration.

He goes on to say that the immediate results of tuberculin are not striking but that there is still an appreciable superiority in the condition of cases which have had a course of tuberculin, when compared with similar and parallel cases which have not. He has not confined its application to incipient cases alone, but has also used it in more advanced cases. “It is rather when studying the effect of the injections on cases somewhat more advanced in the disease, that one notes occasionally rapid and unexpected improvement, and that

the preponderance of improvement seems to be in favor of the patients who have taken tuberculin."

After a careful discussion of its limitations, he concludes: "I nevertheless have formed the impression that the use of tuberculin brings about somewhat better results than can be obtained by sanatorium methods alone, even up to the time of discharge."

Dr. Trudeau's statements are conservative, wise and restrained, as should be the case when endorsing a remedy capable of doing so much harm, but I fancy that one can read between the lines, a high opinion on his part of its therapeutic value. He quotes statistical evidence to confirm this impression. Among other data he furnishes the following suggestive tabulation of the canvass of the post-discharge mortality, bearing on 135 treated and 690 untreated cases discharged in the past fifteen years, from the sanatorium at Saranac, computed on the basis of an equal number of treated and untreated cases.

Equal number of treated and untreated cases in each year.

Excluding all cases who stayed less than three months.

Excluding all cases who left the Sanatorium less than one year ago.

Excluding all untraced cases.

PERCENTAGES.

	Incipient.		Advanced.	
	Living.	Dead.	Living.	Dead.
Tuberculin treated	79	21	61	39
Untreated by tuberculin.....	63	37	36	64

He discusses the factors militating against this table being representative of the absolute effects of the tuberculin treatment in the possible influence of the "selection of cases" for the tuberculin treatment; and the fact that those thus treated often remained much longer at the sanatorium than the untreated.

But Dr. Trudeau's paper is so illuminating in its entirety that it is almost unfair to dissect it for the purpose of quotation. For its interesting details, and comprehensive presentation of the subject, it should be read by all interested in tuberculin therapy.

Drs. Lawrason Brown and E. R. Baldwin of Saranac have been closely associated with Dr. Trudeau in his studies of immunity and his tuberculin therapy. These gentlemen emphasize the care and moderation necessary in the dosage, and the necessity for individualization in each case. The former authority says that in many patients there comes a period of increased susceptibility to the tuberculin injections, when they will react to doses which previously caused no disturbance. The greatest care should be exercised until this period is passed. In the treatment of 70 cases with tuberculin, Brown during the whole course of the injections, produced no reaction in 12 cases, and only 1 reaction in 13 cases, 2 in 13, 4 in 7, and 5 to 11 in 13. In other words, 50 per cent. of the 70 cases had 3 or less reactions during the course of their entire treatment.

Baldwin, while in doubt as to the limits of the reactions or how to explain them, thinks that their proper interpretation is of prime importance. He explains the congestion of the local reaction on the theory that there is secreted an enzyme or some ferment, which digests the toxins, or at least tends to digest them in their simpler forms.

Klebs of Chicago has suggested that in his experience he has at times felt that harm has been done by tuberculin even when no reaction has taken place. He emphasizes the empirical state of our knowledge in regard to the action of tuberculin, and deplors the possibility of a revival of careless experimentation, in which latter view he will be most heartily endorsed by those best qualified to judge.

The so-called tuberculin reaction may be both general and local, and varies in severity according to the dose and the condition of the patient, from a slight rise in temperature to the severer manifestations outlined below.

Before making each injection and following it, a thorough physical examination should be made and accurately recorded for future comparison. The local reaction in the lung manifests itself in evidence of increased vascularity and secretion. Râles may be heard, and the breathing may be slightly exaggerated. There may be increase of cough and of expectoration, and a sense of fulness in the chest. In the larynx, when this is involved, there is increased congestion and even swelling,

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with increased secretion. There may be some irritation at the site of the injection.

The general reaction consists in a rise of temperature and increased rapidity of the pulse. There may be a general depreciation of the patient's condition, with malaise, headache, and anorexia. There is sometimes a certain nervousness preceding and accompanying pains and aching of back, limbs and head, more or less severe. If the dose is pushed unduly, there may be nausea and vomiting, with diarrhea, and even symptoms of collapse.

All severe reactions, and in fact all but the very slightest, which at times seem unavoidable, should be guarded against by the smallness of the dose. In the event of there being a reaction, however slight, the dose should be diminished and not repeated for three or four days or until all signs of the reaction have disappeared. Even when a given dose has not caused a reaction it is well to repeat that same dose after a period of three or four days or a week before proceeding to a larger one. The reactions appear as a rule in from six to twelve hours after an injection and last about the same length of time, if slight; the local reactions being briefer than the general. If a reaction does occur, the patient should be kept in bed until he has returned to his previous condition.

It seems probable that by the use of Wright's method of estimating the effect of tuberculin injec-

tions (and that of other vaccines) in the rise and fall of the curve of the opsonic index of the blood, we may have a practical and scientific basis upon which to regulate the time and dosage of the injections.

For those who would use tuberculin, I would strongly advise beginning with the doses recommended by Trudeau, though larger initial doses of 1-500 to 1-100 mg. may be employed with safety in suitable cases. Increase should be in fractions of about the original dose, with a few days to one week intervening between the injections. Van Ruck begins with an initial dose of 1-20 mg., and says he has never seen a reaction follow this. He increases in fractional doses of 1-10 mg. until he reaches 5 or 10 mg.—or “a point has been reached where the improvement is radical and active symptoms have entirely subsided.” If symptoms return later, he repeats the course.

In conclusion, then, we have in tuberculin a safe and reliable agent for purposes of diagnosis. It should be used in all doubtful cases, as the advantage of the earliest possible institution of treatment in tuberculosis is so great.

The theory of its action may almost be said to be still *sub judice*. The general trend of expert opinion is in favor of its therapeutic use within certain limitations. The latest contributions on the subject go far toward establishing for it a recognized and prominent place among the specific measures or adjuvants to the treatment of tuber-

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culosis. A reservation must be strongly insisted upon, however, in that it is a powerfully acting remedy, a toxin of great potency, and it may do harm as well as good. It should only be employed with the greatest watchfulness and skill, in properly selected cases. It seems reasonably established that tuberculin immunization induced in man exerts a favorable, if not curative, influence on the course of pulmonary tuberculosis.

Let me add that the treatment with tuberculin is not at present practicable outside of specially equipped sanatoria—except in exceptional cases where wealth can bring the facilities of the laboratory to the bedside. It is impracticable to sterilize solutions, and instruments, and to carry out the careful technique of these fractional dilutions without laboratory facilities and expert laboratory aid.

BERANECK'S TUBERCULIN.

Beraneck at the International Congress of Tuberculosis, Paris, 1905, announced a new tuberculin, to the preparation of which he had devoted several years. The following is Dr. R. W. Philip's (Edinburgh) abstract of his communication :

This tuberculin differs from Koch's tuberculin in several respects. The fluid contains (1) extracellular toxins, TB (toxines-bouillons), which Beraneck obtains from a culture of tubercle bacillus on a special medium free of peptones. The solution contains a peculiar florescent substance. Administered to tuberculised guinea-pigs, it produces a pyrexia reac-

tion, but its toxic action is slight. (2) Intra-cellular toxins, AT (acido-toxines), abstracted from the bodies of tubercle bacilli by means of ortho-phosphoric acid (1 per cent.). These acido-toxines give proteid reactions. They are completely different from the nucleo-proteids already separated from the bodies of tubercle bacilli. They are relatively of slight toxicity.

Each of the two constituent elements possesses a certain immunising power. The maximum of immunisation is obtained by a combination of TB and AT. The combined product constitutes Beraneck's tuberculin, which, although only slightly toxic, has marked bactericidal properties. Beraneck's tuberculin is employed both subcutaneously and by direct injection into the tuberculous focus—for example, joints, glands, etc. Beraneck believes that, brought thus directly into contact with the tuberculous lesions, it determines an active phagocytosis, and probably frees bacteriolytic products contained in the phagocytes. Favorable results are produced more quickly by local injection than when the tuberculin is used subcutaneously, more especially in closed tuberculosis, where, it may be supposed, tubercle bacillus is alone present.

Beraneck's communication was restricted to the more scientific aspect of the matter. Clinical evidence in support of his thesis was submitted by himself and other observers. Owing to the arrangements of the Congress, it was unfortunately out of my power to contribute to the discussion. I mention this because it was my purpose to have expressed the opinion, based on an experience of eighteen months, and of more than fifty cases, that in this new tuberculin we have an agent of great value in the treatment of all forms of tuberculous disease. The tuberculin is likewise of diagnostic value.

VON BEHRING'S ANNOUNCEMENT.

The most recent claim relative to a specific therapy was made by von Behring at the International Congress of Tuberculosis in Paris, October, 1905.

While his announcement was premature and therefore unconvincing, yet it is impossible to ignore the claim of so distinguished an investigator, though throughout the scientific and medical world his over hasty announcement has been universally deplored. Shorn of its verbiage and obscure expression, his protocol seems to resolve itself into a statement that during the previous two years he has been occupied with what, he believes, will prove a curative principle in the treatment of tuberculosis. This specific curative principle is not made public by him, but for the purpose of testing it both experimentally and clinically, he has furnished it to certain savants working in harmony with his views.

I will quote Dr. R. W. Philip's (Edinburgh) abstract of his address at the Congress, as it gives as briefly as may be, the gist of the matter:

Proceeding on the lines of Metchnikoff's researches on phagocytosis, von Behring's conception is the establishment of a cellular immunity, rather than an antitoxic humoral immunity. This is effected by the impregnation of the living cells of the organism by a substance emanating from the virus of tuberculosis which he terms TC. When this TC has become incorporated with the cells of animals treated by it, and has been metamorphosed by the cells, TC becomes TX.

This TC or TX, as existing in the tubercle bacillus, plays the part of a formative substance, and also possesses fermentative and catalytic properties. It has a selective action with regard to other substances, and under certain conditions possesses assimilating qualities. It represents the so-called vital principle of the bacillus. In the process of immunisation of cattle

against tuberculosis (von Behring's bovovaccine), von Behring thinks that the TC is freed from other substances, and exercises a specific action on the tissue cells, especially those of the germ centres of lymphatic tissue. Probably the TC is the cause of hyper-sensibility to Koch's tuberculin, and of the protective reaction against tuberculosis.

In the establishment of immunisation the elaboration of TC plays a large part. But such elaboration is a long and dangerous process for the organism. Von Behring's hope is to save the organism the trouble, by the preparation of TC in vitro. Thereby he hopes to substitute active immunisation for passive immunisation. Certain substances of tubercle bacillary origin hinder the therapeutic activity of the TC. The aim of much of von Behring's researches is to free the TC from these. He recognizes three groups of such bacillary substances:

- (1) A substance, TV, only soluble in pure water, and possessing a fermentative and catalytic action. To this subject are due the toxic effects of Koch's tuberculin. One grm. of dry TV is more toxic than a litre of Koch's original tuberculin.
- (2) Globulin TGL, only soluble in neutral saline solutions, and also toxic.
- (3) Several non-toxic substances, only soluble in alcohol, ether, chloroform, etc.

The rest bacillus, that is the tubercle bacillus freed from these three groups of substances, retains the form and staining reactions of the tubercle bacillus. It can be transformed (by means not described) into an amorphous substance readily taken up by the lymphatic cells of a variety of animals, *e.g.*, guinea-pig, rabbit, sheep, goat, ox, and horse. The substance is in turn transformed by the cells of these animals. The cells are rendered oxyphile or eosinophile, and coincidentally there is established, in the organism as a whole, immunity to the tubercle bacillus.

It is of special interest that this TC—though it is incapable of reproduction—possesses the power of giving origin to a special form of tubercle corresponding to that described by Laennec as "granulation tuberculeuse"—a structure which

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neither caseates nor softens. Von Behring believes he has been able to separate this TC in vitro in a form which can be applied efficaciously and without risk for therapeutic purposes, to the human subject.

Von Behring desiderates fuller investigation, both from the pathological and the clinical side, before he announces to the world the details of the method. He emphasises the failure of previous researches in a like direction, citing Koch's old tuberculin and TR, and Maragliano's and Marmorek's serum. He seems to have in view the establishment of check observations on the part of other laboratory workers, and also a series of careful clinical observations, before he goes into further particulars. The earlier stages of his research are to be explained in a forthcoming work, to be entitled "Modern Problems of Phthisiogenic and Phthisiotherapeutic Physiology Enlightened by History."

The reserve and caution suggested by this proposal for delay are commendable. Those who are familiar with the difficulties which attend such a research, both from the pathological and clinical side, will readily accede all that is claimed. But the pity is that the necessary time for complete research and critical re-examination should not have been taken before a single word was emitted about the matter, especially to an audience which included many lay persons.

TOULASE.

Von Behring announced the name, and made a somewhat more detailed statement as to the therapeutic and diagnostic uses of his new remedy, toulase, at the International Conference of Tuberculosis at The Hague, August, 1906.¹

It is given only to clinics which have a chief or assistant who has spent three months at Mar-

¹International Journ. of Tuberculosis, Oct., 1906.

burg studying von Behring's immunising tuberculosis treatment. These experimenters must agree to maintain a connection between their own clinics and Marburg; in addition they must agree to perform their work according to the following routine:

a. The results of their observations must be registered in temperature curves on the same type of charts used at Marburg. (One scheme only is followed.)

b. The agent must be employed according to written agreement, either (1) by mouth or subcutaneously; either (2) periodically or continuously.

c. The dosage, especially the initial dose and the manner of increase to the terminal dose, must be followed as per agreement.

d. The cases must be selected according to age, state of health, hereditary and other influences, having an influence on prognosis. Very important in the selection of patients to be treated is the possibility of supervision over several years.

e. Regular reports must be made to "Behringwerk, Marburg," on the first of each month, no matter whether the toulase cases are being treated actively or have reached a treatment pause.

Nothing is being charged for toulase until experience has definitely determined the best method of application, the proper dose, the indications and contra-indications necessary to induce protection and cure.

Toulase can only be had through "Behringwerk, Marburg," and it will be refused if reports are not forthcoming or the regulations are in any way broken.

No publications concerning results are to be made without asking von Behring's permission.

He will not answer or pay attention to any communications (letter, telephone, telegraph or personal) asking for the "tuberculosis cure." His reasons are these: He has not employed his serum on any animal with tuberculosis, the condition of which corresponds even in a remote degree to that of tuberculous man, and therefore has no scientific basis upon which to say that his toulase is a remedy which will cure human tuberculosis. He has never claimed that his remedy will cure already existing tuberculous destruction, but he claims to have an agent which, when used early enough in young individuals, will prevent tuberculosis and will so react upon foci in existence that their spontaneous cure through the organism's natural resistance will not be prevented by subsequent tuberculous infection.

He will not give his remedy to the public until the fall of this year (1907); it is, therefore, useless for persons (medical or lay) to write for it for exceptional instances.

His experience induces him to permit only the few people personally known to him to aid in experimenting with it.

Therapeutic Remarks Concerning Its Compo-

sition.—Pure toulase is a thin fluid comparable to honey. It contains all the component parts of the tubercle bacillus, which he classifies under three groups of substances:

a. Lipoid substances (neutral fats, varieties of wax and waxoids) soluble in alcohol, acetone, ether, chloroform, toluol, xylol and bensinoform. It includes the acidfast substances, which he has separated in small granules and irregular particles.

b. Protein bodies, extracted from the delipated tubercle bacilli with distilled water and 10 per cent. sodium chloride solution. They are nucleo-albumins and globulins.

c. Proteids, the main part of the remainder of the tubercle bacillus.

Toulase does not induce abscesses nor necrosis. The only local reaction which a watery 10 per cent. solution induces is a swelling, due to an exudation of serous fluid. This is the same reaction observed when injecting diphtheria and tetanus poison for producing antitoxin in horses.

Therapeutic Employment.

It may be used intravenously, subcutaneously and by mouth.

For preventive treatment of nurslings he recommends adding toulase to milk; 0.01 cm. toulase in 100 c.c. milk can be given to the nursling without fear. It should be given but once, or with an interval of eight days, twice. Immunity in ani-

mals has appeared only after several months; therefore the nursling must, during the interval, be carefully protected against the disease. On already existing foci the components contained in toulase, given hypodermically, act in the usual acute manner.

One one-thousandth cm. toulase, as initial dose, can be taken by the most sensitive individuals without any reaction (animal experiments have taught this). Even as much as 0.01 or 0.1 cm. toulase, when given but once, will, in the majority of cases, induce but little temperature change, but will induce a primary loss of weight. He recommends the use of 0.01 cm. as an initial dose. This should be doubled in four successive days. Two to four weeks' rest should follow and the treatment repeated in the same dose.

Subcutaneously the following method should be followed:

a. A small part of the dose, which experience has shown to be tolerated by very sensitive individuals without rise of temperature, should be used as initial dose.

b. It must be doubled daily.

c. After treating ten days, a pause of ten days should be observed. Later the treatment periods must be shortened, the rest periods lengthened.

d. One centigram should be the maximum end dose excepting in special cases, where as much as one decigram or even more may be given. Large

doses may be given, as 1 per cent. toulase emulsion; 0.1 gr. being injected in 10 c.c. of fluid.

At first, ten days will most likely pass without disturbing the general health; if during the latter ten-day treatments the general health suffers, five or even three-day periods must be chosen.

When large doses (more than 1 gr.) are reached, the pauses between injections should be sufficiently long for temperature and general health to reach the normal.

Before making an injection, the toulase in bottle must be agitated so no precipitate will exist.

Toulase comes in glass tubes, the end of which is closed by heat. One-tenth (10 per cent.) or 1-100 (1 per cent.) toulase is contained in each 5 c.c. tube.

After opening the tube the 5 c.c. should be diluted with 45 c.c. of 1-200 Sufon-water, and this 1 per cent. solution placed in a dark, wide-mouthed, glass-stoppered bottle.

Its Diagnostic Use.

The dose of toulase, with which a diagnosis of tuberculosis can be made in bovines, goats, guinea pigs, etc., is not nearly as dangerous and noxious as a diagnostic dose of tuberculin. Toulase is, therefore, to be highly commended for the diagnosis of the disease.

The amount necessary to make a diagnosis in either children or adults can only be determined

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after prolonged research. He believes it to be in the neighborhood of 1 mgr.

One one-hundredth toulase emulsion will induce specific agglutination with the serum of tuberculous individuals. It is equal to the fresh homogenous bouillon culture of Arloing.

CHAPTER VI.

SERUMTHERAPY.

THE difficulties of producing an anti-tuberculous serum are very great because many factors enter into the problem to render it most complex. A serum to theoretically fulfil the conditions in relation to the presence in the human organism of the tubercle bacillus, alone and uncomplicated by mixed infection, should be both antitoxic and bactericidal for it. In other words, it should combat the poisonous general effects of the toxins generated by the bacilli and of the protein poisons contained in the bodies of the bacilli; and should also inhibit the growth of or destroy the bacilli themselves. "One of the great difficulties in the way of producing an anti-tuberculous serum has always been the apparent impossibility of obtaining the sum total of the toxins formed by the tubercle bacillus" (Ravenel). To this in advanced tuberculosis is added the additional factor of the presence of a variety of mixed infections, all producing their particular toxin and all therefore to be reckoned with in addition to the primary infection.

It is hardly to be supposed that a serum so widespread in its action can be produced; and so, in general, investigators have proceeded along the lines of discovering sera which will combat a par-

ticular toxin or group of toxins, or which will be bactericidal in its effect.

The problem in relation to diphtheria was much simpler in that the bacillus here is confined to a particular location, from which it generates a poisonous toxin which circulates in the blood, producing the depression and other dangerous features of the disease. Here the problem resolved itself into the discovery of an antitoxin to combat this uncomplicated though powerful toxin. By neutralizing the toxin circulating in the blood, the bacilli themselves, or their power for harm, was taken from them. This problem has been, as everyone knows, brilliantly solved in von Behring's diphtheria antitoxin. The more complicated aspects of immunization again enter into the problem of an antiserum for typhoid fever, but it is beyond the scope of this chapter to discuss this interesting question in its more complicated phases.

In general, it may be said that in the past fifteen years "all efforts have been directed toward the production of immunity after the methods of Pasteur—by attenuated cultures; or by the use of toxins and products of the tubercle bacillus; or by varying combinations of the two, the object being to bring about a true vaccination against the disease in some of the lower animals, with the formation of antibodies in the blood, which could then be used for the passive immunization, as well as the treatment of man" (Ravenel).

MARAGLIANO'S SERUM.

The most conspicuous of the anti-tuberculous sera is that of Maragliano; and I will speak principally of this because I have used it myself in a small series of cases during the past year, and because I am familiar with the results obtained by my colleagues at the Phipps who have given it a fair trial.

Maragliano claims that "(1) it is possible to produce a specific therapy for tuberculosis; (2) it is possible to immunize the animal organism against tuberculosis as is done in other infectious diseases and that there is good reason to hope for an anti-tuberculous vaccination for man."¹

The blood serum of healthy man has naturally a bactericidal, antitoxic and agglutinating power, which is, in other words, evidence of a natural resistance or defence against tuberculosis. This property is shared, but to a less degree, by the blood serum of the lower animals. Maragliano, following Trudeau,² de Schweinitz,³ and others, found that if a healthy animal were injected with

¹Specific Therapy of Tuberculosis and Vaccination against the Disease. First Annual Report of Phipps Institute. E. Maragliano.

²New York Med. Jour., July 23, 1893; Trans. of Assoc. of Am. Phys., 1903.

³Med. News, 1894. U. S. Dept. of Agr., Bull. 13, 1896.

See also McFadyean, Journ. Comp. Path. and Therap., June, 1901; March, 1902; Pearson & Gilliland, Phila. Med. Journ., Nov. 29, 1902.

tuberculous matter (within certain limits) it stimulated the defences of the body, producing a considerable increase in this triple power. "The bacillary poisons, the bodies of dead bacilli and living bacilli, introduced into the body of a healthy animal, produce in it antitoxins and antibodies and give it a special antitoxic, bactericidal and agglutinating property, while on the other hand they increase in it the destructive power of the tubercle bacilli in the tissues" (Maragliano).

Crudely stated, his plan was by special injections in animals to immunize them or raise their resistance to tuberculosis, and then make use of their blood serum carrying this power, to stimulate a similar power in man. His idea is in harmony with what takes place in a "cure" in tuberculosis. "The proof of my views may be found in the study of persons who have spontaneously recovered from tuberculosis as well as of those who have not recovered from it. In the former we find antitoxin and antibodies in larger quantities in the blood; in the latter we do not find them or only in small quantities" (Maragliano).

After much experimentation Maragliano discarded the injection of living bacilli for the purpose of stimulating this increased resistance in the blood serum of animals, and selected a watery extract of the bodies of dead bacilli (bacillary pulp) supplemented by the filtrate of young virulent cultures. He claims that in this way he gets the sum total of the poisons both of the bacillary

bodies and the toxins. For if the animal is inoculated simply with toxins, it is rich in antitoxins and poor in antibodies; while if it is alone treated with the bodies of dead bacilli or a watery extract of the same, it is rich in antibodies and poor in antitoxins. He prefers horses, cows and calves for the production of his serum. "When the horse, cow or the calf, under proper treatment attains the power of giving a serum which has *at least* a thousand antitoxic units per cubic centimeter, and shows upon every test a bactericidal power and an agglutinating power of at least one to three hundred, such serum may be used for therapeutic purposes, because it contains a sufficient quantity of antitoxin and antibodies."

Koch and his school attach great importance to increase in the agglutinating power of the blood and believe that in this we have the most important element of resistance. Maragliano and his school, while recognizing the importance of the agglutinating power because it runs parallel to the development of the bactericidal property in the blood, believe that the demonstration of this latter quality is an even more convincing evidence of immunity. Maragliano's serum has precipitation power with the homogeneous culture of Arloing and the emulsion of Koch. This property is evidence of, and increases with the bactericidal power of the serum, not with the antitoxic power.

He advises the use of his serum both in suitable ambulatory and ward cases, and claims that under

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its use toxic symptoms are diminished or disappear, and that local inflammation is modified or even arrested, and that the formation of scar tissue is stimulated. In consequence of this there is diminution and disappearance of fever and sweats, of cough and expectoration, and the presence of bacilli. He limits its application to cases before destructive lesions have developed in the lungs resulting from mixed infection, and before the general nutrition has been profoundly affected by the toxemia.

The method of giving the serum at the Phipps Institute, where at first it was obtained directly from Maragliano's laboratory, but subsequently was produced from our own cattle, under Dr. Ravenel's supervision following Maragliano's methods; was 1 c.c. given hypodermically, with aseptic precautions, on alternate days into the pectoral, lumbar or scapular regions for ten days or two weeks. Then 2 c.c. were given on alternate days for a period of two or three months. In some instances longer. The injections are attended by little pain and should be kept up for two or three months. Occasionally they gave rise to local inflammation and abscess, and also a general urticaria. The glands nearest the site of the injections usually become enlarged. In one or two instances a sudden, alarming and momentary syncopal attack followed an injection, with a return to normal appearance and condition almost as unexpected as the original phenomena had been

alarming. No permanent ill effects were noted from the use of the serum. Speaking for myself, I could attribute no improvement in the cases in which I had used it to the serum. So far as I could observe it was without any effect on the course of the disease. Drs. Walsh, Stanton, and Landis contribute the results of their experience with its use to the Second Annual Report of the Phipps in full detail. All our cases were receiving general treatment, a number were ambulatory, and a number were in the wards.

Dr. Walsh, referring to his own cases, concludes:

1. The serum does not by itself produce a gain in weight.
2. No conclusion can be drawn of improvement of lung involvement.
3. The serum had apparently no influence on cough, expectoration nor the presence of bacilli.
4. Pulse and temperature underwent no change; respirations in one case increased in number.
5. The serum usually brought about an increase in the white blood-corpuscles, though this increase was temporary.
6. The serum may have a possible influence on the production of albumen in the urine.

Dr. Stanton draws the following conclusions:

1. Gain in weight occurs as rapidly and to as great an extent in cases not treated by serum as in those treated.
2. Considering the stage of the disease, improvement in the pulmonary symptoms is as great in cases not treated with serum as in those treated.
3. Cough and expectoration lessen to as great a degree in cases untreated with serum as in those treated.

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4. No special effect of the serum upon pulse and temperature could be noted.
5. In one advanced case with the diazo reaction in the urine the use of the serum was accompanied by a rapid loss in weight.
6. It remains to be proved that cases treated with serum show a lessened tendency to relapse or reinfection than cases not so treated.
7. As far as it is possible to judge from so limited an observation, the use of Maragliano serum is not indicated in cases of moderate or advanced tuberculosis.

The only feature of our use of the serum which might militate against our report being considered final is in the selection of cases. None of my own cases, and few of the other cases in which it was used, were free from mixed infection, and even breaking down of lung tissue. The majority of the cases were not incipient, though there were incipient cases in the series.

I have also used the serum in 3 c.c. doses by the mouth, every second or third day in ambulatory cases, as practiced by Maragliano, but without noticeable effect. Maragliano further suggests the use of the milk and meat of immunized cattle as part of the diet of the tuberculous individual, as he claims that they too possess the power of stimulating an increased resistance in the latter, but to a much less extent, of course, than the blood serum of the animals.

In conclusion, Maragliano's work along the line of the discovery of a specific serum for tuberculosis is suggestive and worthy of the closest study.

“He has undoubtedly proved his claim in regard to producing a serum which protects experimental animals against the poisons of the tubercle bacillus, so far as we have been able to obtain them; and also against the tubercle bacillus itself in pure culture, when given in doses which do not overwhelm the animal, but which have been shown to be fatal” (Ravenel).

This vaccination of healthy animals against subsequent tuberculous infection is a different proposition, however, to curing man after he has already got the disease. From my own experience and the experience of my colleagues it would seem very doubtful if Maragliano's serum will do all or even a little of what he claims for it. Granting that the cases in which we tried it were in most instances complicated by mixed infection (which from his standpoint render them unsuitable), we can yet say with Stanton—as far as it is possible to judge from a limited experience, Maragliano's serum is useless in cases of moderately advanced or advanced tuberculosis.

MARMOREK'S SERUM.

Following his views as to the action of tuberculin which differ widely from those commonly accepted, Marmorek produces a special toxin by growing tubercle bacilli on a so-called leucotoxin serum, obtained by injecting calves with the leucocytes of guinea pigs. His idea being to use a

culture media upon which tubercle bacilli will produce as much toxin and as little tuberculin as possible. By the addition of a glycerin bouillon made from liver, and by carrying the bacilli through successive growths on this special culture media, he increases their virulency and produces a toxin which is almost free from tuberculin. He obtains his serum by successive injections of this special toxin into the horse.

His serum has been quite widely tested abroad and opinions differ as to its efficacy. The reports of Dieulafoy, Hallopeau, and Lucas-Champouniere in France, are unfavorable to it, while other investigators, among whom may be mentioned Latham in England, Frey in Germany, and Richer in Canada, speak favorably of it. (Ravenel.)

Marmorek presented a paper at the Paris Congress (1905) on the results of its use, and claimed that the symptoms and condition of three-quarters of the cases of pulmonary tuberculosis treated, were ameliorated, and that the number of bacilli in the sputum diminished or even disappeared. He says that good results are even more marked in surgical tuberculosis. The general opinion of those who discussed his paper seemed to be that in most cases there was an amelioration in symptoms, and that there was no great danger or risk in its use. It is given subcutaneously and by the rectum.

ANTISTREPTOCOCCIC SERUM.

It is not strange that, appreciating the important rôle played in pulmonary tuberculosis by the pus-producing bacteria, experimentation should have followed along the lines of combating or neutralizing their action. The part played by streptococci, pneumococci, and other forms of mixed infections, in breaking down lung tissue, and cavity formation, in causing the grave symptoms of toxemia of advanced cases, in furnishing the exciting cause of hemorrhage (elsewhere dwelt upon in these pages) cannot be too strongly emphasized.

Antistreptococcic serum has not, in the somewhat tentative and empirical trials made of it, been attended with much success in the treatment of tuberculosis. One of the difficulties has been in the variety of types of streptococci and the difference in the virulency of the toxin produced by the different types. As a rule the micro-organisms infecting the lung are of low virulency, while the antistreptococcic sera on the market are produced from the more virulent germ. An antiserum produced from less virulent strains, or from the particular strain or strains found in the lungs, may be supposed to possess certain advantages in combating the toxin produced in the lungs. The error has been in a sense one of the preparation of the serum. Another factor influencing clinical results is the advanced stage of the disease, in

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which it is indicated, and the already serious condition of the patient.

To a certain extent, at least, this error in the serum has been overcome, by preparing the serum from one or more of the less virulent strains of streptococci or from the strains found in the lung. Upon the authority of Ravenel, it may be stated that a serum thus specially prepared, exerts a predominant influence over the weaker toxins of the types found in the lung. Reports of its use are, so far, too few to justify great claims for it. The most favorable results have been obtained by Bonney of Denver.¹ Out of twenty-five cases of advanced pulmonary tuberculosis, "in which the serum was not employed in any case save as a last resort and only after other measures of regimen and climate had proven of no avail," the results were as follows:

Case 1 presented such remarkable improvement as to insure practically a complete and permanent recovery. Case 13 secured speedy termination of a streptococcic pneumonia. Case 8 recovered promptly from a severe septic pneumonia following hemorrhage, and now bids fair to secure an arrest of the original infection. These represent the best possible results.

Four cases showed very marked improvement, directly attributable to the serum, and of sufficient extent to turn the prognostic balance in favor of ultimate arrest.

¹Four Months' Experience with Anti-Streptococcic Serum in Pulmonary Tuberculosis. S. G. Bonney, *Med. News*, June 13, 1903, and subsequent reports.

Five cases all exhibit definite improvement, although the final prognosis is as yet uncertain.

Eight cases showed a degree of improvement but not such as to materially modify a previous unfavorable prognosis.

Three cases in which the effect of the serum, if any, remains in doubt; and three cases in which no actual result was exhibited.

In a later paper,¹ Bonney in relation to the use of antistreptococcic serum concludes as follows:

1. About one case out of every four or five may be reasonably expected to exhibit a pronounced diminution of temperature by the end of a week or ten days.
2. The remaining cases do not show any bad results from its employment, other than due to the occasional intolerance of the system for the serum of a horse.
3. This so-called reaction which is independent of the specific nature of the remedy, but common to all other serum preparations, bears no relation to the ultimate results obtained.
4. Some cases show marked improvement in spite of temporary discomfort in the way of chills, fever, urticaria and painful swelling with stiffness of the joints, while others exhibit no improvement, although there is entire absence of constitutional disturbance.
5. Reaction may take place within twelve hours after the use of the serum or it may be delayed for six weeks.
6. Occasionally the improvement is delayed indefinitely until the occurrence of the reaction, following which there may be complete and enduring subsidence of the fever.
7. As a result of the serum the temperature either may subside

¹Care of Far-Advanced Cases of Pulmonary Tuberculosis, Boston Med. & Surg. Journal, August 30, 1906.

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to normal or may be reduced several degrees, remaining, however, somewhat elevated.

8. I have not been in favor of its continued subcutaneous employment, and have given, as a rule, not over four or five doses at intervals of one or two days and awaited results.
9. During the past nine months I have practiced the tentative administration of the remedy by the rectum for ten or twelve doses before resorting to its hypodermic use, in order to avoid the discomfort which sometimes follows its injection into the tissues.
10. I have seen unquestionably good results attend its use even when streptococci were not found in the sputum, and believe that even under such conditions the clinical evidences of a persisting sepsis may sometimes afford from a humanitarian standpoint a warrantable basis for its use.

The serum is indicated in cases which exhibit marked evidence of streptococcic infection, in the sputum and in the clinical symptoms. It therefore is distinctly limited to the more advanced cases with yellowish and greenish-yellow expectoration containing numerous streptococci, and when there is toxemia, *i.e.*, irregular temperature, night-sweats, chills, etc. It will correspondingly be the more welcome to clinicians should it prove to have a distinct effect in a class of cases in which the prognosis is so serious or at least so doubtful.

Bonney made, as a rule, three or four subcutaneous injections in his cases. In most instances he gave one dose and watched the results, which if effective consisted in a fall of temperature and general improvement of the toxic symptoms. The temperature in most instances remained down for

a variable period, from a few days to several weeks. With the tendency of the fever to rise, he repeated the dose. In some cases successive doses were given for two days and a third dose a few days later.

No untoward accidents nor ill effects attended the use of the serum, though in one case there was great prostration following an injection, with symptoms of collapse, from which the patient was rescued by appropriate stimulation. Sometimes an urticaria, and general tenderness and pain in the joints were noted.

The antistreptococcic sera on the market do not seem to act particularly well. More may be expected from the preparation of a special serum, with more specific action. The serum is given hypodermatically or by the rectum in doses of 10 to 20 c.c.; if the latter method is chosen the dose should be correspondingly increased.

ANTISTREPTOLYTIC SERUM.

In antistreptolytic serum we have an agent which is not antitoxic in its action but bactericidal for streptococci. This again has not been sufficiently tested out to say definitely of what value it may prove in combating mixed infection. Pottinger and Browning report twenty cases treated with it.¹ They used it only in cases in which

¹A Clinical Study of Mixed Infection in Tuberculosis. Jour. Am. Med. Assn.

streptococci were found in the sputum, with clinical evidences of mixed infection; and while in a number of cases following its use streptococci disappeared from the sputum, they estimated the improvement solely from the clinical course. There was in nearly every case a favorable change in the character and amount of the sputum. It became thinner, less purulent, and diminished in amount. Many of the cases while under sanatorium treatment had not been doing well and some were in bad condition. They noted a distinct improvement in the general condition of 17 of the 20 cases treated. The fever was reduced, the sweats and chills ceased, and the patients began to gain in weight. The improvement was, of course, not equally marked in all cases.

At first they gave the serum subcutaneously, usually beginning with 20 c.c. and following with 10 c.c. a day. Severe reactions, however, followed quite frequently in urticaria, severe pains in the joints, and purpura. In one case the patient became cyanosed and a fatal collapse was feared, but the patient was restored to his normal condition and no ill effects followed.

They subsequently used the serum by the bowel without producing any of the trying symptoms mentioned above, except in one case where there was some soreness of the finger joints. In association with the use of the serum all other measures of treatment were administered as seemed best. The serum was given daily by the rectum

in 10 to 20 c.c. doses, and was kept up for three or four weeks. Their conclusions in relation to the serum are as follows:

The streptococcus plays a part, at least in some cases of so-called mixed infection in tuberculosis, and streptolytic serum has at least some specific action on the streptococcus, as witnessed in the reduction of fever and abatement of symptoms in some of these cases of hectic type; and further, the streptococcus plays some part in the general pathology of the tuberculous process of these chronic cases without marked symptoms (the earlier ones we have not yet investigated), as is shown by the altered character of the sputum, becoming thinner, less purulent and diminished in amount, and in the general improvement which follows the administration of the serum in nearly all cases.

The use of streptolytic serum in cases where no acute symptoms were present seemed to exert a favorable influence on the course of the disease sufficiently often to suggest that the presence of the streptococcus affects the tuberculous process unfavorably, even in many cases where it causes no active symptoms, and that mixed infection is a factor to be recognized and dealt with, before the advent of threatening symptoms, the same as tuberculosis is to be treated before the advent of consumption.

SERUM DIAGNOSIS.

Finally, in this connection just a word about the serum diagnosis of tuberculosis as advanced by Arloing and Courmont, with their homogeneous culture *A*. Kinghorn and Twichell have recently published¹ the results of their work along this

¹Am. Journ. of the Med. Sciences, Oct., 1906.

line, following the formula and method in all essential details of the French investigators. The total number of cases tested was 247, of which 70 were in apparently good health; 155 had pulmonary tuberculosis, and 22 were doubtful. Of the 247 cases tested, 212 reacted positively (85.22 per cent.); 35 failed to react (14.18 per cent.). Of the 70 healthy persons, 59 reacted positively (84.28 per cent.); 11 failed to react (15.72 per cent.). Of the 155 cases with pulmonary tuberculosis, 135 reacted positively (87.09 per cent.); 20 failed to react (12.91 per cent.). Of the 22 patients with suspicious signs, 18 reacted positively (86.36 per cent.), and 4 failed to react (18.13 per cent.).

In persons in apparently good health, Courmont obtained 26.80 per cent. of positive reactions, and 73.20 per cent. of negative reactions, as against 84.28 per cent. positive, and 15.72 per cent. negative in the above series. In clinical cases of tuberculosis, Courmont obtained 87.90 per cent. of positive reactions, and 12.10 per cent. of negative reactions, as against 87.09 per cent. positive and 12.91 per cent. negative reactions in the above series.

Kinghorn and Twichell claim that the larger the number of healthy serums tested the higher the percentage of reactions rose. In their judgment there is little if any difference between the agglutinating power of healthy and of tuberculous serums—namely, 84.28 per cent. for healthy, and

87.09 per cent. for tuberculous serums. The average agglutination was also practically the same—namely, 14.82 for tuberculous patients and 13.67 for healthy persons. Hence they conclude that the serum diagnosis of tuberculosis as used by Arloing and Courmont is not a specific sign of the presence of clinical tuberculosis, since healthy and tuberculous serums have practically the same agglutinating property; and further that the serum diagnosis of tuberculosis, and especially for the early diagnosis of tuberculosis, is of no value.

CHAPTER VII.

DRUGS.

A DRUG should only be used in tuberculosis where there is a distinct indication for it. It should be given as a rule alone, and not in combination with other drugs, as mixtures often upset the digestion when the single agent would not. Whenever a drug is recommended below, it presupposes that the patient is not taking other drugs, or at most one other drug. The simpler our therapy in tuberculosis the better. The drugs which are of service are very few. These are, however, when properly exhibited, of the greatest service, particularly in tiding the organism over trying periods and in warding off complications.

The physician should not feel that he must keep giving something, nor that he must treat every symptom which a patient with a vagarious imagination may complain of. The essentials of the treatment should be kept steadily in view, and everything made subservient to them. Any remedy or drug which does not subserve this purpose is unwise. Neurasthenic patients like to lie back and allow their imaginations to work. They will think up symptoms, imaginary heart- or headaches, trifling pains in any part of the body, with which to greet the doctor. Never be led into pre-

scribing for these, but treat all symptoms not in themselves of moment by reassurance and encouragement. Lead the patient's thoughts to brighter things, cheer him up, reassure him on the score of his improvement and go away—without having given any medicine.

CREOSOTE.

Creosote is eliminated largely through the lungs and has been found abundantly in the sputum of tuberculous patients when being administered (Cotillon). It thus exerts its antiseptic action directly, and while it apparently has no influence on the growth and development of the tubercle bacillus, it cannot be doubted that it exerts an almost specific action on the bacteria of mixed infection.

It has been used by direct injections and also by inhalations of its vapor. The former procedure does not seem warranted in view of its severity. Mild inhalations may be resorted to at times with apparent benefit in allaying cough and reducing bronchial catarrh. In view of its ready elimination through the lungs, however, its local action can best be secured by its internal administration. Aside from its local antiseptic action, it is a valuable stimulant expectorant.

It is also valuable, particularly in small doses, as a carminative, in preventing and reducing gastro-intestinal fermentation. On account of its

antiseptic action in the gastro-intestinal tract, it is used in intestinal tuberculosis.

In my own experience creosote has proved of the very greatest value in suitable cases. Those who have administered it properly and have had the greatest experience with it will concur in this dictum. It is important that pure beechwood creosote be used, and it should be given in hot water on an empty stomach. The method followed at the Phipps Institute is to begin with one or two drops three times a day, half an hour before meals (or a milk-and-egg period), in a tablespoonful of water, as hot as can be borne, for each drop. It is increased a drop a day, with the addition of a tablespoonful of hot water for each additional drop until the patient is taking at least twenty to thirty drops three times a day. It should be stirred or shaken in the hot water until every particle of oily matter has disappeared. This takes half a minute or more, as it is soluble with difficulty.

Creosote is eliminated by the gastro-intestinal tract and by the kidneys, but also and very largely by the mucous membrane of the lungs and air passages. There can be no doubt that it exerts a direct antiseptic action by its method of elimination in this latter way.

There is no drug which I have seen act so satisfactorily and so convincingly as creosote. The improvement is often immediate, and, by a little experimentation, one can readily satisfy oneself

that the improvement is not coincidental, but may be definitely attributed to the continued use of the drug.

The objection usually raised to creosote, that it is, in large doses, apt to upset the stomach, is not justified by the widest experience. There are cases, I suppose, who cannot take it, as there are cases who cannot take milk. I can only say that I have known of very few. In small doses it has long been recognized as one of the most valuable carminatives and intestinal antiseptics in the pharmacopeia. In small doses it greatly improves digestion, and by gradually increasing it, and prescribing it in hot water on an empty stomach, a tolerance to the larger doses is readily established. Personally, I never push it beyond 20 or 30 drops three times a day; and sometimes I am satisfied on reaching 15, though this latter dose is not adequate.

H. A. Hare says: "Often as much as a drachm a day can be given by gradually producing tolerance through ascending doses; and it is worthy of note that in most instances large doses are required if satisfactory results are to be obtained."

It should be occasionally intermitted for a week or two, as any drug kept up continually establishes a tolerance which diminishes its therapeutic effect. Upon starting again, a return should be made to a smaller dose and the process of increasing a drop a day repeated.

Creosote is particularly indicated in advanced cases, suffering from mixed infection, and such cases bear this drug remarkably well. It manifests its action in the lungs themselves by diminishing secretion, and reducing the signs of moisture and thus, at least, indirectly favoring fibroid change. It has marked effect on the walls of productive cavities, and under its use râles diminish, the expectoration grows less, and the signs of toxemia abate in a marked degree. There follows remarkable and often unexpected improvement in the patient's general nutrition, with increase of appetite and increased power of assimilation. It has a beneficial influence on the entire gastrointestinal tract. Indeed, I have seen this drug work wonders in apparently hopeless cases, and I believe it should be used in all cases (within certain limitations) where there is evidence of mixed infection. If it should prove that it did not agree with a particular patient it should, of course, be given up. The patient will be little or no worse off (and that only temporarily) for the tentative use of what will generally prove a most valuable remedy.

Creosote seems to have little or no direct effect on the growth or development of the tubercle bacillus, but it influences most favorably the local process by its almost specific action on streptococci, and other pyogenic organs, which often dominate the conditions. It should always be tried in cases with profuse muco-purulent expec-

toration, and in the so-called "nummular" sputum, containing numerous streptococci and staphylococci. Under its use there is diminution in the cough and change in the character of the sputum, from being thick, mucopurulent and copious, it becomes thin, mucoid, and small in amount. In other words, the mixed infection is mitigated, and this is further shown in a general improvement, in the disappearance of chills and heavy sweats, and a reduction of the high and irregular fever.

Cornet, Sommerbrodt and others endorse it highly. The former says: "In cases in which the expectoration is very abundant and full of bacilli, creosote diminishes the amount and retards or even arrests the process. The essential factor is probably the improvement of the digestion (Klemperer), of the appetite and nutrition, which is at times seen to follow its use."

Burroughs of Asheville speaks highly of its use when given in suitable amounts, but says that 10-minim doses three times a day are too small to be of any service except in partially preventing fermentation and thereby assisting digestion. He gets his patients to taking at least 30 and sometimes as high as 90 drops three times a day; and adds that "it is the rarest occurrence that a patient comes under my care who cannot take creosote."

E. E. Graham gives a most favorable report of its use in children, advocating large doses which,

he says, do not upset the digestion, and cause not only improvement in cough and expectoration, but also marked general improvement—"Many children will easily take 15 drops three times a day, and 40-drop doses will not be followed by any disagreeable consequence in a few."

The toxic symptoms of full doses of creosote, which call for an immediate reduction in the dose, are headache and slight vertigo. If unduly pushed a tendency to heaviness and stupor develops, and dark or smoky urine may supervene, as noted in carbolic acid poisoning.

On account of its antiseptic and favorable action on the gastro-intestinal tract, creosote has been used where there is intestinal tuberculosis. It exerts an irritative action on the kidneys, and the urine of the cases taking it should be watched. It follows that it is contra-indicated in marked organic disease of the kidneys. Most advanced cases of pulmonary tuberculosis have a complicating kidney condition either in the presence of miliary tubercles, or of a true chronic parenchymatous nephritis. It is in this latter condition, when marked, that creosote should be used with caution. Creosote should not be used when there is frank hemorrhage from the lung.

There are certain derivatives and modifications of creosote which are recommended by competent observers. Jacobi, following Schüller, speaks highly of guaiacol and guaiacol carbonate in not only tuberculosis of the lungs, but of the bladder

and kidneys, and in bone and cutaneous lesions. He claims in common with Schüller, Nordt and others that "invariably appetite and strength increased, expectoration became easier, cough less and looser, pus was replaced by mucus, and the results of percussion and auscultation became more favorable. A visible effect on the number of tubercle bacilli in the sputum was obtained after a long interval only.¹

The only criticism I should like to offer is in his method of administering it—in combination with a variety of other drugs. I believe these combinations are as a rule distinctly bad, that they often upset the digestion, and that the simpler our therapeutics in tuberculosis the more satisfactory the results. I think we should use a particular drug with a specific purpose and should prescribe it alone, in order that its action may not be obscured or modified by other influences.

Cornet thinks that creosotal or the carbonate of creosote is superior to the pure drug in being better borne by the stomach and less irritating, while at the same time producing an equal improvement in the appetite and strength, and a diminution of secretion. Creosotal is prescribed in the same manner as creosote, beginning with five drops three times a day, and increasing slowly up to thirty drops, with occasional intermissions.

¹Exile and Drugs in the Treatment of Tuberculosis. *Amer. Medicine*, December 23, 1905.

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When starting again after an intermission, a return should be made to a smaller dose.

This latter authority also prefers the carbonate of guaiacol (duotal) to guaiacol itself for the same reasons.

Another derivative of creosote is the valerianate (geosot). This has been lauded by Rieck, Zinn, Grawitz, Wainwright, and others. It is claimed that it is more agreeable and less irritating to the stomach than the pure drug.

While admitting that the carbonates, the valerianates and guaiacol are better borne by the stomach or are less irritating, they are just so much the less effective in their therapeutic strength and activity, and the dose must be correspondingly larger to be as effective, so that the effect on the stomach remains pretty nearly the same. Creosotal and guaiacol contain from 60 to 90 per cent. of creosote. From my experience with the pure drug, I have found it so favorably borne and so admirably effective, that I feel justified in sticking to it and heartily endorsing it.

IODIN.

Iodin has long been recognized as having a curative value in tuberculosis. It is widely used in indolent enlargement of the glands, in tuberculous joints and bone affections, and in all forms of chronic scrofulous manifestations. It is applied locally as iodoform, or as unguentum iodi.

Its action is antiseptic, as well as stimulant and constructive, and it belongs to the so-called "alteratives" of the therapists.

Reasoning from analogy it would be fair to suppose that it might exert a favorable influence on the local process in the lung, and clinical empiricism has borne this out.

Flick holds a high opinion of its efficacy in pulmonary tuberculosis, and goes so far as to say, "of the drugs which make for immunity, the most valuable in my opinion is iodine. I have seen many remarkable evidences of it. In the early stages of the disease it is practically a specific, and as far as I know there is no contra-indication to the employment of iodine in tuberculosis, though the prospect of deriving benefit from it decreases with the advancement of the disease."

While believing that it is a valuable drug, I should not attribute any "immunizing" or "specific" power to it, but believe that it exerts a favorable influence more directly as an antiseptic, and stimulant to tissue change. I therefore expect more from it in chronic cases, with evidence of fibroid repair, than in the more acute forms of tuberculosis. Though its use being unattended by danger, there is no reason why it should not be employed in the more acute forms, particularly by local application to the pharynx as outlined below.

Iodin is absorbed into all the tissues and fluids of the body, even into serous and other exudates (Tench), and is eliminated in the bronchial and

pulmonary secretions, in the saliva, and from the kidneys, intestines, skin, and in the milk of nursing women. Its elimination may be detected in the saliva even after it has ceased in the urine (See). It is consequently fair to assume that it comes directly in contact with the local process in the lungs and exerts there a direct antiseptic action. There is no evidence to prove that it is capable of destroying the life of tubercle bacilli in this way, but it probably inhibits their growth and has a more definite action on the more feeble organisms of mixed infection.

On account of its irritant and caustic properties, it is difficult to prescribe iodine internally, nor do I consider this method of exhibiting it a good one in tuberculosis for obvious reasons. Recently H. H. Malone ¹ has reported favorably on the internal administration of iodine and phenol in combination. He emphasizes the antiseptic and constructive power of both these drugs, especially phenol in the presence of albuminous materials, like bacteria and molds, and also chemical ferments or enzymes; and claims that phenol renders the iodine less irritating to the stomach and permits of its freer administration. By special preparation, consisting in suitable dilution and subsequent emulsification, he claims that his mixture can be given in increasingly large doses without disturb-

¹An Antiseptic Treatment of Tuberculosis. Jour. Am. Med. Assoc., September 8, 1906.

ing the stomach and with gratifying results. I have spoken elsewhere of my objection to mixtures in general, and particularly to those which may upset the digestive function.

Piorry recommends inhalations of the vapor of iodine in tuberculosis. H. C. Wood thinks that in very chronic cases this may be of service in stimulating the bronchial mucosa and the surface of cavities.

It has also been given hypodermatically, but there is great danger of producing marked local inflammation. Squier has used it in the following formula, which he claims may be injected with little or no pain.

R Iodi..... gr. iv ;
 Iodoformi gr. viij ;
 Guaiacol (pure)..... ℥xvj ;
 Eucalyptol ℥xxxij ;
 Oleum Amygdalæ Dulcis (sterilized) q. s. ad f 3 j.
 M. et sig. Ten to thirty minims hypodermatically.

The best method of administering iodine is by inunction in the form of eucophen in olive oil. By this method there is no danger of disturbing digestion nor of irritant local effects. Eucophen is very rich in iodine, and in solution parts readily with it. The curative influence of the iodine is thus exerted directly through the blood.

Iodine, when directly applied to the skin in the form of the tincture, is not absorbed, or at least in relatively small amounts. Eucophen in solu-

tion or ointment does not blister nor discolor the skin as the tincture of iodine does, nor has it the unpleasant odor of iodoform.

Europhen in powder is not as generally useful in the treatment of surgical tuberculosis as iodoform, as in the powdered state it is five times as bulky, and parts with its iodine very slowly. Its use in this respect has been mainly restricted to those cases where a drying powder is needed which will by its bulk inhibit secretion and keep the wound pure by making it too dry for the favorable development of germs. On account of its slow decomposition, there is less likelihood of its giving rise to toxic symptoms from iodine absorption than iodoform. It is probably more irritating than the latter.

The results of the local application of europhen in solution to the pharynx where there is congestion, or chronic inflammation or induration, are most gratifying. Its continued use on the pharynx will clear up chronic indolent inflammation or congestion in a way which no other drug will do with which I am familiar. It is much used on the throat in tuberculosis for this reason. Free applications to the pharynx with a camel-hair brush should be made morning and evening, and a drachm of the solution rubbed into the axilla or groin once a day.

As most tuberculous patients have a complicating throat condition, however slight, and as the influence of iodine through the circulation is dis-

tinctly beneficial in whatever its specific action may consist, euophen in solution may be very generally used, both in incipient and advanced cases. It is likewise harmless when exhibited in this way.

It is used a great deal at the Phipps Institute with gratifying results, and I have myself employed it largely, following the formula of Dr. Flick as follows :

R Euophen ʒij;
 Oleum Rosæ..... mʒij;
 Oleum Gaultheriæ,
 Oleum Anisi..... āā fʒij;
 Oleum Olivæ q. s. ad fʒvj.

M. et sig. Paint throat night and morning, and one teaspoonful by inunction.

Iodin may also be prescribed in the following formula :

R Iodi (crystal)..... gr. xxx;
 Lanolini (anhydrati)..... fʒss;
 Oleum Gossypii..... ad fʒvj.
 Ætheris Sulphuric, q. s.

M. et sig. Teaspoonful by inunction twice daily.

NITROGLYCERIN.

Nitroglycerin is indicated in tuberculosis where there is rapidity of the pulse and accentuation of the second sound of the heart. As this condition of circulation is present in most cases with fever, I use it a good deal, with the purpose of quieting the

heart's action and dilating the peripheral vessels. It also relieves the spasm and engorgement of the mucus membrane of the bronchial tubes. It relieves the strain or tenseness in the pulmonary vessels and reduces the likelihood of hemorrhage. Dr. Flick, who first used this drug in this way, believes that the incidence of hemorrhage in his practice has been materially reduced from this cause. This opinion from one of his large experience and close powers of observation is worthy of consideration.¹

On the first visit of a patient, where there is rapid pulse and accentuation of the pulmonic second sound, it is my habit, in the absence of other indications, to give him a prescription for nitroglycerin, to be taken in doses of 1-100 grain after meals. If he has been bleeding, or there is evidence of local congestion, it is given four times a day, or even oftener. It is well to increase the dose to the point where its effect on the circulation is appreciable.

Nitroglycerin does not upset the digestion, and exerts a favorable influence as indicated above. The official Spiritus Glycerylis Nitratis in one minim doses (gr. 1-100) should be used when possible, in preference to 1-100 grain tablets, as the latter seem to lose their strength, particularly if they are not fresh. Nitroglycerin is a safe drug

¹Nitroglycerin as a Hemostatic in Hemoptysis, Phila. Med. Jour., Feb., 1898.

to use, and one very fugacious in its action. If there are indications for increase of dose, in extreme rapidity of the heart or marked accentuation of the second sounds of the heart, or in blood-streaked expectoration, it may be safely run up to a hundredth of a grain every two or three hours. If the patient complains of fulness in the head, or headache under its administration, it is well to cut the dose down somewhat, though it is quite remarkable how quickly a tolerance to the larger doses is established.

Nitroglycerin is perhaps one of the most, if not the most valuable drug, we have in the treatment of hemorrhage, where there is overaction of the heart and high tension in the peripheral circulation. A full consideration of its use in this relation follows below.

It has also been used where there is suspected toxic nephritis or miliary tubercles in the kidneys. Here it increases the secretion of urine, and relieves the distressing lumbar pains, sometimes a feature of this condition.

It may be given after meals, in those cases where creosote is being taken before. As cough medicines are rarely used to-day in the treatment of tuberculosis, this arrangement in suitable cases is all the medication required, and will be well borne by the stomach. In those cases where creosote is not indicated, a thirtieth of strychnia may be given a half hour before meals (with a view to stimulating the appetite and also

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for its general tonic effect) and a hundredth of nitroglycerin after meals.

The use of single drugs, as outlined above, certainly as a routine practice, is the kind of medication, if any, called for in tuberculosis. The more or less elaborate cough mixtures, stomachics and tonics, sometimes used, are quite likely to do more harm than good.

Sodium nitrite is said to have an advantage over nitroglycerin in being more permanent in its effect. It is used in the same way and given in doses of 3 to 5 grains, three times a day or oftener, as indicated.

THE SALTS.

CONSTIPATION AND DIARRHEA.

The salts are the laxative par excellence in tuberculosis. Constipation is at times a troublesome symptom of the full diet and want of exercise, and it is fortunate that we have such favorably acting drugs to control this symptom. If the bowels are costive, they should be kept freely open by their use. Any of the preparations are serviceable, though I have come to prefer magnesium sulphate. One or two good movements a day should be secured. Two full teaspoonfuls in a half glass of water (preferably hot) may be given in the morning before food. This will usually suffice to produce the desired result. If the action is too free, the dose should be reduced.

Magnesium sulphate is useful in many ways, and like a life preserver on a troubled sea, it should be ever at hand. If the patient feels heavy, or has slight headache—Epsom salts. If there is hypertension in the circulation with palpitation and dyspnea—Epsom salts. If there is anorexia, or slight nausea—Epsom salts. I have outlined its use in this rather colloquial fashion, to convey the idea of its general utility. Whenever in doubt, or whenever the patient complains of symptoms without definite indications for a particular drug—Epsom salts.

By depleting the intestinal tract, it favors the glandular and motor activity of the stomach; at the same time, it carries off the undigested residue of the intestines, and in this way favors the digestive process and prevents the danger of fermentation and autointoxication.

It is often the only drug needed to control flatulence and distention, where it occurs, from the large quantities of milk. Patients who do not take their milk slowly and almost “chew” it, will at times suffer from this symptom. It is not very uncommon to have patients, particularly if confined to bed, complain of more or less severe pains in the abdomen. These attacks of pain occur intermittently, sometimes every few days, sometimes at night. Patients will often attribute such phenomena to taking cold. It is usually an evidence of mild autointoxication, and salts will relieve it promptly. The so-called effervescing

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draught is a pleasant and effective preparation. A teaspoonful or two may be given in a glass of water. The following prescription is useful as a mild laxative and stomachic:

R Magnesii Sulphatis..... ʒjss;
 Acidi Sulphur. Aromat. fʒij;
 Aq. Cinnamomi..... q. s. ad fʒvj.
 Sig. A tablespoonful after meals and at bedtime.

Wherever there is engorgement or acute inflammation in the lungs, salts have a most salutary effect in depleting the circulation without loss of blood. They are accordingly useful in blood spitting and in hemorrhage. A patient who is in danger of having hemorrhage or has already had it, should be freely purged. The purpose being to increase the consistency and coagulability of the blood by drawing off the serum, through depletion of the intestinal mucosa and vessels. A relatively large amount of body fluid is lost in this way.

Magnesium sulphate is also useful in diarrhea, the result of intestinal fermentation. It is infinitely better to treat diarrhea in tuberculosis by small and frequently repeated doses of magnesium sulphate, than to lock up the bowels and retain unabsorbed or fermenting food residue, by bismuth or similarly acting drugs. Where diarrhea is due to cold the question is different.

In diarrhea resulting from cold or catarrhal inflammation of the transverse colon or intestines,

bismuth may be prescribed. It may be given in five-grain powders, with an equal amount of pepsin every hour or two hours, or in a solution as follows:

R Bismuthi Salicylatis ʒij;
 Crete preparatæ..... fʒiv;
 Aqua Cinnamomi..... fʒiiij.

Sig. Teaspoonful every hour or two hours.

Or it may be combined with salol in capsules as follows:

R Bismuthi Salicylatis,
 Guaiacol Carb., or Salol..... āā ʒj.
 Div. in cap. No. xxiv.

Sig. One every hour or two hours.

Opium or its derivatives should be avoided here as elsewhere in the treatment of tuberculosis.

The following prescription of Sir Andrew Clark is often effective:

R Ferri Sulph..... gr. xxiv;
 Mag. Sulph..... ʒj;
 Acidi Sulph. Aromat..... ʒj;
 Syr. Zingib..... ʒij;
 Inf. Quassia.....q. s. ad fʒviiij.

Sig. Tablespoonful three or four times a day.

The following prescription, modified from Osler, is effective in checking diarrhea in tuberculosis:

R Plumbi Acetat..... ʒi;
 Acidi Acetici dil..... fʒjss;
 Syr. Simp..... fʒiv;
 Aq. Cinnamomiq. s. ad fʒiiij.

Sig. fʒj three or four times a day.

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As originally suggested by Dr. Osler, it contained a twenty-fourth of morphine acetate to the teaspoonful, or one grain to the above mixture. This naturally increases its effectiveness for general use, but had best be omitted in tuberculosis.

I have used the following with success in the control of diarrhea where astringents seemed indicated:

R Acidi Sulph. Aromat.,
 Ext. Hæmotoxyl Fluid.....āā ʒij;
 Bismuthi Salicylatis,
 Syr. Zingib.ad fʒiij.
Sig. Teaspoonful every two hours.

Dr. Flick reports most satisfactory results in the treatment of intestinal tuberculosis by small and frequently repeated doses of magnesium sulphate, unassociated with other medication. It is probable that in this condition the retained toxins and products of the local ulceration play an important rôle in causing diarrhea and in preventing the healing of the local lesion. Certainly measures applied with a view to checking the diarrhea and healing the ulcers by the local action of astringent drugs, are most ineffectual and lead to a marked deterioration in the patient's general condition. Magnesium sulphate may be given daily in ten- or twenty-grain doses every half hour until clear, watery stools result. Under this course the movements soon become clear and watery, and tenesmus is relieved. By keeping

the ulcerating surface of the gut free from undigested residue, there is a much better chance of the formation of granulation tissue and subsequent healing than by any other course. While having six to eight small and watery stools a day, the patient under a full diet of milk and eggs will gain in weight, and his general condition improve. By locking up the bowels nothing is gained and much is lost. I have known of patients who have been completely cured under this treatment, after the other and more usual line of treatment has failed signally and greatly impaired their general condition.

This line of treatment is particularly applicable to those cases of intestinal tuberculosis which are up and about, and are afebrile; and in whom the local process in the lung may have been satisfactorily arrested. Creosote in conjunction with the salts is of advantage through its antiseptic action. The creosote may be used in three to five minim doses three times a day, or when indicated by the presence of mixed infection in the lungs, run up to the usual larger dosage of 20 to 30 minims.

Magnesium sulphate seems to have some slight advantage over Rochelle salts (*Sodii et Potasii Tartras*) and citrate of magnesia, though these latter are valuable in the same way. Rochelle salts are not quite so active, though they are fractionally less irritating, while citrate of magnesia is more irritating, yet more agreeable to the taste. Any one of the three will answer the pur-

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pose well, though my personal preference is for magnesium sulphate.

The salts purge by abstracting the serum from the intestinal vessels, and by stimulating peristalsis directly. They are also not readily absorbed, so that they produce a watery evacuation much of which is serum from the intestine and some of which is the original solution of salt. They should be given preferably in concentrated form.

STRYCHNINE.

No drug is more generally useful or more available routinely in tuberculosis than strychnine. It not only stimulates the appetite, but directly increases the digestive function by increasing the volume of gastric juice and the motor power of the stomach. But its action is wider than that of a mere stomachic, for it is a most useful tonic where there are general relaxation and loss of nerve tone. It has a most favorable influence on general nutrition. It stimulates not only spinal motor nerve centres, but also the vasomotor system and probably also the trophic nerve centres, and these play an important rôle both in the general relaxation and muscular weakness and in the progress of the local process.

Strychnine is also a powerful respiratory stimulant, particularly in the more chronic cases associated with dilatation of the heart. Here it may be advantageously combined with digitalis.

It is also useful in constipation, where it acts not only by stimulating the gastric function, but also by toning up the muscular coat of the bowel. In anorexia and other mild gastric disturbances it is well given combined with the bitter tonics or stomachics, as outlined later. It is a useful adjunct to the treatment of dyspepsia, or of diarrhea, where atony or muscular relaxation is a factor.

It is also a mental stimulant, and is useful in combating the depressing mental effects seen in some cases from the prolonged inactivity of tuberculosis. Where there are neurasthenic symptoms it is also useful and should be given in full doses over a long period. Though our knowledge of the cardiac action of strychnine is still imperfect it is probable that the small dose has a stimulating effect upon the heart.

Nux vomica may be used, though I prefer the more powerful and more definite action of the alkaloid. H. C. Wood says: "Practically there is no qualitative difference between the medical action of strychnine and that of the cruder preparations of nux vomica, over which it usually should have preference on account of definiteness of action."

Strychnine sulphate may be given in doses of one-fortieth to one-twentieth of a grain three times a day. Unless the patient is taking creosote (before meals), I give it half an hour before meals; if the patient is taking creosote, I give it after meals.

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ARSENIC AND IRON.

ANEMIA.

Arsenic in small doses is a useful drug in the treatment of tuberculosis. It improves nutrition and has also been claimed to stimulate the living tissues in their struggle against the bacillus. Buchner claimed that it has a marked effect in quieting the local process. It is used in all stages of the disease, but it is particularly useful in chronic fibroid cases associated with anemia. From its value in the treatment of chronic bronchitis and asthma, it is of service where these conditions are associated factors. It has a distinct influence as an alterative and expectorant in these latter cases. It is an irritant to the stomach and must therefore be used in small doses. In chronic fibroid cases with anemia it may be given in the form of arsenic iodide in doses of one-thirtieth grain three times a day, or Fowler's solution (1 per cent.) two to five drops in a wine-glass of water after meals, the dose being slowly increased.

Iron must be used with caution and in small doses in tuberculosis as it upsets the stomach and produces constipation. It is probable that its chief usefulness is in its stimulating influence upon the blood-making organs, or those which produce red blood-corpuscles; and in increasing the ozonizing power of the blood. It is also claimed that it supplies the glandular tissues with blood-making material. It is, therefore, like arsenic, of service in chronic cases with anemia.

It is a useful tonic in convalescence, and I have frequently used the Elixir Ferri, Quininæ et Strychninæ, in drachm doses after meals, with marked benefit.

Anemia is not usually a prominent factor in tuberculosis. The increased nutrition, rest and fresh air are successful measures in combating it. But where it is wished to give iron and arsenic, there are several good preparations. Arsenate of iron (ferri arsenas) in doses of 1-20 to 1-16 grain is a useful preparation. It is asserted that this is not productive of local or renal irritation, and may therefore be used with safety and even with benefit to the kidneys where there is a complicating tuberculous or toxic nephritis. Basham's mixture in drachm doses three times a day is also useful.

Where there has been marked anemia during convalescence I have used the carbonate of iron and arsenious acid in the form of the modified Blaud pill, or *Pilulæ Ferri Carbonatis* (U. S.) cum acido arsenoso, gr. 1-40. One pill is given after meals and the number may be increased to two, three times a day.

DIGITALIS.

CARDIAC WEAKNESS. DYSPNEA.

Digitalis was at one time widely used in the treatment of tuberculosis and was even lauded as a specific. It is probable that it is of greater use than is generally supposed, and indeed in certain

cases acts remarkably well. There is some uncertainty as to just the kind of cases in which it may be depended on. For routine use it seems quite ineffective; nor have I always, in cases with a relaxed cardio-vascular system where it would seem particularly indicated, been much impressed by its efficiency.

In some cases, however, where there has been marked dyspnea and cardiac weakness, I have seen it act remarkably well. It is well associated with nitroglycerin or strychnine.

Where there is overaction or palpitation of the heart an ice-bag to the precardium is of service. Rest is indicated here, of course, and either digitalis or nitroglycerin may be given in full doses. Often nitroglycerin seems to be more effective in reducing the action of the heart than digitalis. This is particularly the case where the heart is hypertrophied, and the tension in the arterial system high. Digitalis should not be used under these latter conditions. But where the heart is dilated and weak or irregular, and where the pulse tension is below normal, digitalis should always be tried.

Digitalis does not seem to accomplish much when there is much fever, nor when there is much myocardial degeneration of the heart.

Digitalis has proved more useful in my hands in chronic cases with little or no fever, and where an emphysematous condition had produced dilatation of the right heart. Here I have seen it act quite magically by restoring power to the heart,

giving tone to the circulation, and relieving troublesome dyspnea.

Dyspnea resulting from a dilated heart or the stagnation of secretions is often materially benefited by light exercise, graduated to the general condition of the patient. This is especially applicable in chronic cases with an asthmatic tendency; and in the absence of fever or other contraindications, a mild course on the principles of the Nauheim system is useful in reducing the size of the heart, and relieving peripheral engorgement and stagnation. In this way it materially aids digestion and metabolic processes throughout the body, improves nutrition, and relieves dyspnea and chronic irritative cough.

OPIMUM.

It is very ill-advised to prescribe opium in any form in tuberculosis. One dose of a quarter of a grain of morphine and a hundred and fiftieth of atropine is permissible on the occurrence of frank hemorrhage, given with a view to quieting the patient. The use of opium in cough mixtures or diarrhea mixtures is distinctly bad practice.

Opium, according to H. C. Wood, is eliminated in all the secretions and excretions of the body. It may be detected in the gastric juice (Orlt), in the saliva (Rosenthal), in the urine (Hilger, Bauchardat, etc.). The most important channel of elimination is probably the alimentary tract (Faust). It is found in the liver, the brain, and

the kidneys after death (Antheaume and Mounpyrat). It checks every secretion of the body with the exception of that of the skin (Hare).

Without discussing at length its physiological action, opium is particularly contraindicated in tuberculosis on account of its action on secretions. It lessens the secretion of gastric juice and destroys the ability to take food and to assimilate it. It produces anorexia and often nausea and vomiting. It also reduces the motor power of the stomach and bowel. In other words, it locks up the glandular secretions and arrests peristalsis.

It exerts this same influence on mucous membranes generally, and reduces the secretions from the bronchi and lungs. It thus exerts an unfavorable action in tuberculosis by locking up the secretions and retaining the effete products in the lungs. It reduces the muscular tone of the lungs, directly, by its inhibitory influence through the nervous system, and thus reduces the excretion of carbonic acid gas and other effete products of metabolism. It also increases the activity of the local tuberculous process by increasing the destruction of nitrogenous tissue (Luzzatto).

The only circumstance in which the use of opium seems justifiable is, when the patient is slowly dying, to make his last hours as comfortable as possible. In this way, I have used it after a pneumothorax has developed, or when severe pleuritic pains or racking cough add unnecessary torment to a necessarily fatal termination.

CHAPTER VIII.

SYMPTOMS.

COUGH.

COUGH in pulmonary tuberculosis requires, as a rule, no special treatment other than rest and local treatment of the throat. It may result from irritation of the bronchial mucosa, from collecting secretion in the lungs themselves, or from inflammation of the larynx or pharynx.

Advanced cases with much cough and expectoration should be confined to bed. Rest and quiet are the best remedies for cough. This, combined with creosote, when there is muco-purulent expectoration, is the only proper course. In patients confined to bed, even though very far advanced in the disease, with evidences of mixed infection, cough soon ceases to be a troublesome factor. In a very short while after rest is instituted, there is a perceptible diminution in the cough, and it ceases to be out of proportion to the secretion ; in other words, it ceases to be more than is required to raise the secretion. Inflammation is allayed and secretion itself diminishes. The rest allays the inflammation, and the creosote reduces materially the secretion. Anyone will be struck by the absence

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of severe or much coughing in visiting the wards of a hospital where cases are managed in this way.

It is a grave mistake to use cough mixtures to control cough. Not only will they not control it, but they destroy the ability to take and assimilate food and upset the digestion. Cough mixtures containing opium or any of its derivatives should be especially avoided. It is the gravest mistake to attempt to control cough and lock up the secretion by drugs.

By the exercise of a little will power patients can assist materially in the control of cough. This is particularly true of excessive or irritative cough, which does not serve the purpose of eliminating secretion. The impulse to cough should be resisted and this may be further aided by a few deep inspirations. Sometimes a few sips of cold water or the sucking of a little ice will help to relieve the tickling or the desire to cough. Where there is no tendency to frank hemorrhage, mild inhalations of soothing vapors, as outlined below, are without danger and often of the greatest service in this regard.

Where there are productive cavities, a reasonable amount of cough is necessary and serves a useful purpose in raising the secretion.

As H. C. Wood well says in a general consideration of the subject: "When obnoxious materials, be they secretions or foreign matters, accumulate in the bronchial tubes, cough is necessary for their

expulsion, so that in a large proportion of cases no treatment of cough is desirable.

“On the other hand, there are cases in which, owing to excessive irritability of the pulmonic mucous membrane, the amount of cough is out of all proportion to the amount of material expelled. Under these circumstances the symptom is annoying; but also, by irritating the mucous membrane of the lungs and by exhausting the patient, directly harmful.”

Here is our indication for rest to relieve congestion and allay irritation:

“In another set of cases, owing to muscular weakness and lack of irritability of the mucous membrane, the cough is not sufficient for the expelling of the secretions, which gradually accumulate in the lungs and fill up the bronchial tubes.” In tuberculous cases of this type creosote is usually indicated to combat mixed infection.

The irritative cough may be controlled by local applications to the larynx or pharynx, and by applying iodine or small blisters to the chest. Soothing vapors may be of service. I sometimes make use of the following by mild inhalations:

R Creosotum (beechwood),
Conium,
Mentholää f3ij.

M. et sig. Ten drops in hot water. Inhale four or five times a day or before retiring.

Attention should always be given to the nose and throat. Daily applications of eucalypti oil,

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as outlined above under the consideration of iodine, should be made, and when possible the assistance of a specialist should be had for careful and systematic local treatment of the pharynx.

Care of the nose and throat cannot be emphasized too strongly as an essential part of the treatment of cough.

It should be an exceptional thing to have to prescribe a cough mixture for patients who can avail themselves of more rational treatment. Sometimes when a patient is up and going about, and expectorating from relaxed mucous membranes, a stimulating expectorant like ammonium chloride will recommend itself. The salts of ammonium seem to be the best expectorants for general application, as they are a general as well as local tonic. It should not be forgotten that they are irritants to the stomach. The more powerfully acting expectorants, like turpentine, tar, and the oils, should never be used, as they will inevitably interfere with digestion if they do not actively upset the stomach.

I sometimes use the following prescription in ambulatory cases where it is impossible to institute a proper regimen:

R Am. Chlor..... ʒiv;
Pancreatin..... ʒij;
Spts. Glonoini..... ℥ xxiv;
Elixir Calisayæ..... ad fʒvj.

Sig. Teaspoonful every three or four hours.

The spirits of glonoin may be left out where there is not rapidity or hypertension of the pulse and aromatic spirits of ammonia substituted as follows:

R Am. Chlor. ʒiv;
 Pancreatin ʒij;
 Spts. Am. Aromat. fʒj;
 Elixir Calisayæ.....ad fʒvj.

Sig. fʒj every three or four hours.

Rarely when there is a dry, irritative cough which keeps the patient awake at night and which does not respond to local measures, I have gone outside the pale, and used "Elixir Heroin and Turpentine Hydrate," giving one or two doses, beginning late in the afternoon. Though I believe thoroughly that heroin and codeine and the other derivatives of opium are distinctly inimical to the local process and the general condition of the patient. They should not be used when they can be avoided, and only then tentatively and temporarily.

HEMORRHAGE.

The occurrence of hemorrhage in the course of pulmonary tuberculosis is always an alarming symptom to the patient and a source of anxiety to the physician. Much depends on the source of the hemorrhage as to its seriousness and as to the effect of treatment. In general, the effect of drugs is but palliative, as we possess no drug

which will actively check the bleeding, particularly if it comes from an eroded vessel of large calibre in a cavity or ulcer.

In the application of the general measures of absolute quiet and cold locally, we possess, I believe, our strongest weapons in combating this dangerous accident. Views as to the efficiency of different drugs vary so from time to time, are influenced so much by new experimental evidence (not always to be credited with too much weight, particularly when it opposes long clinical experience), that drugs exploited as effective a few years ago, and universally used, are to-day discarded for new favorites, with the result that in a really bad pinch we know not where to turn. As a matter of fact, in bad hemorrhages they are all inadequate, as one would expect from the nature of the lesion; while in other cases, under the use of general measures, the bleeding will stop—I had almost said, in spite of medication. The treatment of hemorrhage for those who have not seen the severer forms appears quite satisfactory, but there are times when drugs seem but straws in the path of a rising tide. Fortunately, the severer forms are not common, while moderate hemorrhage is readily controlled; and slight bleeding (blood-streaked sputum) is not usually a dangerous nor even a serious symptom, except in the possibility of its being a forerunner of a frank outbreak.

The occurrence of frank hemorrhage, by which

is meant free bleeding (a half pint or more), may sometimes be prognosticated in advance by the presence of small amounts of blood in the sputum and a sense of constriction, oppression, or tickling in the chest. I have known of patients, subject to hemorrhages, who could tell in this way in the morning of the day they would have an outbreak. Such symptoms or sensations on the part of sensible patients are worthy of attention, and absolute rest, with ice locally, and free purgation to deplete the system or the local congestion, should at once be instituted.

Rarely, profuse uncontrollable hemorrhage in advanced cases, usually from the rupture of an aneurismal dilatation of a large vessel traversing the floor of an ulcer or cavity, or a succession of profuse bleedings from this source, will prove rapidly fatal by practically exsanguinating the patient. This is not common. It is impossible to check hemorrhage of this character, and the only available measures are absolute rest, with ice locally to heart and lungs, and a hypodermic of morphine, gr. $\frac{1}{4}$, repeated as the physician may deem expedient. Firm bandages should be applied to the extremities and the loss of blood repaired as far as may be by hypodermoclysis with normal salt solution.

It seems very doubtful if many of the drugs usually advocated under these circumstances, like oil of erigeron, turpentine, gallic and tannic acid, lead acetate, sesquichloride of iron, ergot and the

rest are of much service. As the late Austin Flint well says: "After a pretty large experience with these remedies, I find it difficult to form any positive opinion as to their value. They often seem to have no effect as hæmostatics, and when hemorrhage ceases under their use, there is always room for the supposition that the cessation is due to an intrinsic tendency thereto, rather than to the remedies." In this same class may be put calcium chloride and gelatine—though more may be expected in a general way from the continued use of these latter than from the former larger group.

In the treatment of hemorrhage we must differentiate between those cases in which there is circulatory hypertension, *i.e.*, rapid high tension pulse and accentuation of the aortic second sound; and those cases in which there is not. In the former, nitroglycerin often acts particularly well; in the latter it is of no service and seems contraindicated. In this latter group, I should rely on adrenalin.

Clinical and experimental evidence in favor of the group of drugs derived from the suprarenal bodies, like adrenalin chloride, suprarenal extract, and adrin, is too strong to be ignored. Where nitroglycerin is not indicated in circulatory hypertension, any of these, particularly adrenalin chloride, appear to act most satisfactorily. This powerful hemostatic exerts its best influence where it can be applied locally, but there can be no doubt of its power to influence favorably internal hemor-

rhage by acting through the circulation. It may be given in doses of 1-50 to 1-10 of a grain, intravenously or hypodermatically. There is danger when exhibited in the latter manner of producing a slough, so that the former method seems preferable. If given by the mouth, the pure solution as sold in sealed ounce bottles (Parke, Davis & Co.) should be used, in which a half drachm equals approximately a thirtieth of a grain. This dose should be given in a little water, and following severe hemorrhage I have used it every hour for five or six doses, and then lengthened the intervals to two and three hours. Used in this way it seems to exert an appreciable effect on the bleeding. In less severe hemorrhage it may be given three or four times a day in the above dose. It is claimed by the therapeutists that adrenalin chloride is decomposed by the acid of the gastric juice, and that it is also less effective when injected into the tissues, than when thrown directly into the circulation.

Only in very alarming hemorrhage, associated with great anxiety on the part of the patient, would I advocate the use of morphine. An initial dose of 1-4 morphine and 1-150 of atropine (hypodermically) is always permissible to quiet the patient. Morphine in small and frequently repeated doses will sometimes stop hemorrhage which fails to respond to other measures, or in conjunction with them. It may be given in 1-8 or 1-12 grain doses every half hour, up to a point

where there is danger of narcotizing the patient. It is doubtful if there is much advantage in stopping hemorrhage in this way, as the effect of the morphine is very unfavorable both on the local process and general condition of the patient. In very bad bleeding, however, one must sometimes have recourse to its use.

When, however, the bleeding is from smaller vessels and is not so great we should be careful how we handle it in order not to do more harm than good by our medication. Here I should strongly condemn the use of morphine, and should trust to rest and ice locally, with fractional doses of nitroglycerin to lower blood pressure when this is a factor. I believe that the best and most effective adjuvants we have in combating bleeding from the lungs are absolute rest and cold to the part. Where the patient is nervous or restless and needs a sedative, I would greatly prefer sodium bromide in 5-grain hourly doses to morphine. Where there is need of a stimulant, aromatic spirits of ammonia may be added to the above in fifteen minim doses.

A prescription such as the following will be found useful during the early stages of hemorrhage, where hypertension in the circulation is a factor:

R	Spiritus Glycerylis Nitratis	℥j;
	Spiritus Ammon. Arom.....	℥xv;
	Sodii Bromidi.....	gr. v;
	Aq. Cinnamomi	fʒj.
Sig. fʒj every hour for five doses.		

It will not do to prescribe the above measure and then go away. When giving nitroglycerin in the dosage recommended in this chapter, it is necessary to watch the patient closely. One gives it up to its physiological limit with the definite purpose of reducing blood pressure, and one is not satisfied until this result is attained. Its action is fugitive and not accumulative, so that it must be repeated frequently. The intervals between doses should be gradually lengthened to two or three hours, until finally after the first day or two, following the cessation of bleeding, it should be continued in one-minim doses of the official spirits four times a day.

Satisfactory results have been reported from the treatment of hemorrhage by inhalations of amyl nitrite.

From experimental evidence, calcium chloride seems to be practically the only agent, with the possible exception of gelatine, which increases the coagulability of the blood. There seems no doubt from experimental study and clinical tests that it does diminish materially the time required for clot formation. For this reason I am very much in favor of using it where the occurrence of hemorrhage is to be feared, and following hemorrhage, in those cases, where it has already occurred. It is not a drug that will avail much in an emergency; its best results may be looked for when it is kept up over a considerable period. It should not, however, be continued longer than

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three or four days, as after this it is said to have the contrary effect in reducing the coagulability of the blood. It may then be intermitted for a course with adrenalin chloride, and returned to later if so desired. It may be given in full doses, *i.e.*, five grains every two hours as follows:

R Calcii Chloridi ʒij;
 Aquæ Puræ fʒiij.
 Sig. fʒj every two hours.

Gelatine may be prescribed in the form of jelly three times a day. Even with some flavoring like cherry, orange, or vanilla, it soon becomes unpalatable, and most patients cannot take it very long. It may be given hypodermatically following the formula of Lancereaux and Paulesco as follows:

R Gelatine,
 Sod. Chloridi āā gr. cl. (10.0 c.c.);
 Aquæ Distillat. Oij (1000 c.c.).

This mixture is sterilized by heat and 2 ounces (60 c.c.) are injected into the tissues of the thigh or buttock. This may be increased to 5 ounces (150 c.c.) in later injections. The gelatine should be boiled at least an hour, as tetanus spores may be present and are only killed with considerable difficulty.

According to modern views, the erosion of blood vessels in a cavity or the extension of the tuberculous process, is not the direct cause of bleeding, except in so far as this is the result of acute mixed infection. The mixed infections responsible for attacks of hemorrhage are usually the pneumo-

coccus, combined with the streptococcus and staphylococcus. A certain number of hemorrhages follow exposure, mental excitement and over-exertion, as walking, riding, playing tennis or lifting; but it is now becoming recognized that hemorrhage is an infection and is contagious. It occurs epidemically in the tuberculous wards of hospitals following the admission of a case with hemorrhage or with pneumonia, and it follows colds. In reports which are becoming more numerous with closer observation, it arises too frequently in this way to be attributed to mere coincidence. Further, bacteriological examination of the hemorrhagic blood shows the presence in large numbers of these pathogenic bacteria, particularly the pneumococcus. Flick, Ravenel and Irwin have investigated epidemics occurring in the wards of the Phipps Institute and at White Haven, and their reports are extremely suggestive.¹

Thus the exciting cause of hemorrhage is often mental excitement or physical exertion, and it may arise in this way, in vessels already exposed from rise in blood pressure distending and snapping a pulmonary vessel. There has, however, in such cases, always been mixed infection and destruction of tissue in the past. It is probably due more frequently than is supposed to an infection with

¹The Pneumococcus as a Factor in Hemorrhage, *Med. News*, Sept., 1895, and subsequent report.

the pneumococcus and pus-producing bacteria, which by setting up an active congestion and inflammation, lead to the rupture of the diseased and fragile vessels. Both causes may operate in harmony, the mixed infection acting as a predisposing factor, rendering slight exertion responsible for rupture, which would not otherwise be sufficient to cause it.

Free hemorrhage cannot occur when there is no cavity and no rupture of vessels. The tuberculous process is a constructive rather than a destructive process, so long as it is uncomplicated by mixed infection. It tends to cicatrization, fibroid change and thrombosis. It is the mixed infections which bring about destruction of tissue with ulceration or cavity formation. Thus we must surely look upon hemorrhage as evidence of pneumococcic and pus infection, either at some previous period by which cavities have been already formed and the vessels exposed and weakened, or at the time of the hemorrhage producing rupture by their inflammatory action.

There must always be rupture of vessels to have frank hemorrhage, but this rupture may be very minute and quite general in the congested area. The whole fabric is, as it were, rotten and permeable. No gross rupture of larger vessels may be discoverable, but the smaller vessels and capillaries are engorged, dilated and relaxed. All have taken part in the bleeding, and their walls are the seat of numerous impalpable ruptures. They

have become in other words, freely permeable from the inflammation, congestion, and vasomotor relaxation.

In this connection, chronic inflammation of the naso-pharynx becomes an important factor in the occurrence and recurrence of hemorrhages, as by harboring the pathogenic bacteria of mixed infection, it furnishes the ever present source for infection of the lung, the natural resistance of which has been reduced by the tuberculous process. In the treatment of tuberculosis, therefore, care of the naso-pharynx, not only following hemorrhage, in preventing *recurrence*, but also in preventing the *occurrence* of hemorrhage, becomes a most important factor. Chronic inflammation or congestion of the pharynx and tonsils, chronic inflammation or obstruction in the nasal passages, should receive appropriate and continued treatment. Inflammation of the naso-pharynx more or less chronic, more or less severe, nearly always accompanies pulmonary tuberculosis; and the condition of the naso-pharynx should be improved to the normal. This is nearly always possible and is most essential in the prevention of the constant danger of mixed infection arising from this source.

Hemorrhages often arise in patients with chronically inflamed throats, suffering from acute colds or bronchitis, with local evidence of pneumonic consolidation in tubular breathing and impaired resonance. The bowels are constipated, and there is fever, rapid pulse and cough. This class of

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cases, and it comprises the majority of hemorrhagic cases, yields as a rule readily to the treatment outlined below. There is another class in which high arterial tension (without evidence of local inflammation), as manifested by the pulse and by sharp accentuation of the aortic second sound, is a factor in the causation of hemorrhage. It is in these later cases, that the hemorrhage most frequently follows mental excitement or exertion, and yields most satisfactorily to nitroglycerin. When the hemorrhage is due to severe acute mixed infection without circulatory hypertension, as more often occurs in afebrile cases in good general condition, the treatment with nitroglycerin is not satisfactory, and more reliance may be placed in adrenalin.

Where the blood pressure is high, however, the strongest indication seems to be to reduce the action of the heart and lower blood pressure in order to stimulate the formation of clot. From our knowledge of the action of drugs it is hardly reasonable to suppose that we can close a gaping vessel by their action, even though the effect of the drug is to powerfully constrict vessels. The greatest argument against this class of drugs is that they raise blood pressure, and by increasing the force of the circulation in the vessels of the lung and at the same time constricting them, they increase, by this back pressure, not only the continuance of the original bleeding but the likelihood of further rupture.

From my own experience and that of others with which I am familiar, I feel justified in heartily endorsing nitroglycerin as indicated. I look upon the action of nitroglycerin somewhat as follows, and trust that the clumsy simile may be pardoned: The tire of an automobile, when the fabric has become worn and rotten, begins to bulge in different localities. This bulging is more marked the harder the tire is pumped up with air. The greater is the likelihood of rupture, the greater the internal pressure and the greater the motion of the automobile. With much speed, over a rough road, rupture inevitably follows. By letting out a little air, and running the automobile very circumspectly, the danger of rupture is reduced to a minimum. If sufficient air is let out, and the automobile is standing still, the areas of bulging will completely disappear and there is little or no danger of rupture.

Nitroglycerin acts in this way,—it reduces the blood pressure and it relaxes the walls of the vessels themselves, thus reducing the strain under which they are laboring. Drugs that constrict the vessels and raise the blood pressure have quite the contrary effect, and increase to my mind the danger of hemorrhage.

But, however we may attempt to explain it or reason upon the premises, the hard clinical fact remains that nitroglycerin does exert a favorable influence in hemorrhage associated with high arterial tension. It is not in any sense specific,

but it is a valuable palliative adjuvant to general measures—which I shall outline below, and upon which I place the greatest reliance. For it should be borne in mind that except in the severer hemorrhages from large eroded vessels (which are not common, but which when they do occur are often fatal), the loss of blood in hemorrhage is not of itself the dangerous or even serious feature of the attack. The danger of hemorrhage, as a rule, lies not in the loss of blood (that is quickly repaired by the organism), but in the lighting up and extension of the tuberculous process. Even small oozings and the consequent contamination of adjacent lung tissue by the infected blood may and often do lead to the extension of the disease downward into previous healthy lung tissue, or the lighting up of a chronic process. Further, the presence of the dead blood in the tissues furnishes a fertile soil for the growth of pathogenic bacteria and the development of a septic pneumonia. The retained clots act as a favorable culture media for the growth of the pneumococci, streptococci and staphylococci, and the more dead blood and the more pathogenic bacteria locked up together in the lung tissue, the worse it is for the patient. This in itself is a strong argument against the use of morphine, or drugs similar in action, which, aside from the depressing general effect, lock up dead blood and secretions in the lung, and by so doing directly increase the danger of extension of the tuberculous process, or the development of a



FIG. 7.—Cupping for localized congestion. Patient had blood-streaked sputum, with numerous pneumococci.

septic pneumonia. It follows that the coughing up of redundant blood clots is a favorable feature following hemorrhage, as in this way the danger of infection and extension is materially reduced.

When a patient begins to bleed in tuberculosis, be it much or little, he should be put to bed. This is not understood to apply to blood-streaked sputum,—in this circumstance it may be sufficient to confine him to a reclining chair, provided his temperature warrants it. The patient should be put at absolute rest on the flat of his back, with his head supported by one or two pillows as he prefers. Talking must be forbidden. No warm drinks, alcoholic or otherwise, and no solid foods are permitted. Cracked ice in small amounts, may be given to suck. An ice-bag should be put over the pericardium and another over the source of the hemorrhage. If there is much pneumonic consolidation, a flat, suitably shaped ice-bag should be placed under the affected lobe as the congestion is apt to be more marked or to extend posteriorly. Ice-bags should be thoroughly dried and wrapped in a towel or piece of flannel. If there is much anxiety or restlessness on the part of the patient, a single dose of a quarter of a grain of morphine and a hundred and fiftieth of atropine is permissible,—to be followed if necessary by five-grain hourly doses of sodium bromide. The physician's manner should be calm and reassuring, whatever misgivings he may cherish in his heart; and he should reassure the

patient on the score of loss of blood. The idea of spitting up "their life blood" is naturally contemplated with terror even by the stoutest hearted. Where possible, morphine should not be used. I have avoided its use with gratifying results in large and alarming hemorrhages. Nitroglycerin should at once be begun, in 1-100 grain doses every hour, if the indication in high arterial tension exists, and kept up until its physiological action is complained of by the patient, when it should be cut down to two and then three-hour periods. It is most important to get the bowels freely opened, and for this purpose magnesium sulphate in half drachm or drachm doses in water should be given every half hour until the bowels are freely moved. A bed-pan should always be used.

After the frank bleeding has ceased, if there is evidence in the lung of congestion associated with blood-streaked sputum, dry or wet cups should be applied over the area of congestion. At first in front, and as soon as the patient can be moved with safety, to the back. Two dry cups in the morning and the same in the afternoon are sufficient; or an ounce, to an ounce and a half, of blood should be withdrawn by wet cups. Strapping the chest or the affected side is sometimes of service in limiting motion.

Where the pulse is weak and the heart's action irregular or unsatisfactory, and there seems to be general relaxation of the arterial system, digi-

talis may be given in addition to nitroglycerin or in place of it. Unless a strong cardiac stimulant is distinctly called for, however, it is better to rely on a diffusible stimulant like aromatic spirits of ammonia, in small doses every hour, or strychnia gr. 1-30 every three or four hours, for general stimulation.

In bad hemorrhage, dry cups applied to the chest anteriorly and posteriorly should be resorted to. This measure was much used by the older practitioners with the idea of withdrawing blood from the general circulation and relieving local congestion. The circulation in the extremities may be temporarily cut off (20 minutes) by ligatures applied to legs and arms or by bandaging the extremities. This detains the blood in the veins beyond the ligatures and secures the effect of venesection; or, as suggested by Austin Flint, loose ligatures may be applied to the four extremities, and tightened when the hemorrhage recurs. Hot water bottles, hypodermoclysis, and other measures of stimulation must be resorted to when the danger of collapse is imminent, in the hope that by prolonging the heart's action a clot will form. This sometimes takes place in very grave bleedings, apparently from the very reduction in volume, and slowing, of the blood current.

Absolute rest, with ice locally, and the use of nitroglycerin, or in the other class of cases adrenalin, should be kept up for a week or two following the acute bleeding. The ice-bags may then

be dispensed with and the nitroglycerin or adrenalin cut down to three or four doses a day. Following a bad hemorrhage the patient should be fed only on milk and eggs, given at three-hour periods. A glass of milk and one egg, beginning at 7 A.M., is sufficient for a few days, following which the diet may be systematically increased.

After the arrest of free hemorrhage the patient should be kept in bed at least ten days or two weeks, if afebrile, in order to allow sufficient time for resolution of the pneumonic process and organization of the clot. If there is fever he should be confined to bed until it remains consistently at or below ninety-nine and a half. Following the period in bed, he should be restricted to a reclining chair, and should only begin to go about with the utmost precaution.

The hemorrhagic blood should be investigated bacteriologically by animal inoculation and growth on culture media. The blood if very toxic inoculated into white mice will kill them in two to four days and pneumococci in pure culture can be obtained. Streptococci will also be found, and tubercle bacilli, as a rule, in large numbers. Such examinations should be repeated every week or ten days, and as the patient's condition improves, the virulency of the infection will diminish, but pneumococci may not disappear from the sputum for a long time. And even when they do, there is no guarantee that they may not be dormant in the affected area. Consequently there must be exer-

cised the greatest care in order to guard against exertion and "colds," lest the process at any moment be lighted up and another hemorrhage result. The sudden outbreak of severe fresh hemorrhage without apparent cause in a patient apparently doing well, is an unpleasant and not unknown occurrence. The spitting up of small clots and blood-streaked sputum will often last ten days, two weeks, or longer, following a frank hemorrhage. During this time, therefore, the utmost precautions should be taken against even the slightest exposure or slight exertions, as might be involved in attempts to wash the patient or change his bed clothes.

During his convalescence, he should have the strictest attention, and treatment of his nose and throat in order to guard against the danger of reinfection from this source.

GASTRO-INTESTINAL TRACT.

While the treatment of the disease itself in its various manifestations should always be kept clearly in mind and be the chief aim of our therapeutics, yet it should never be forgotten that the cure or arrest of the disease is fundamentally accomplished by the improvement of nutrition. Much depends upon the assimilating power of the organism and the maintaining of the functional welfare of the gastro-intestinal tract. By this means is accomplished that increased vitality whereby the system throws off the disease through

resistance to the extension of the local process, and its final fibroid transformation or isolation. This increased vitality or energy, for want of a more definitive term, takes place primarily through increased assimilation.

Unavoidably an extra amount of work is demanded of the gastro-intestinal tract, because the tissue waste must be overcome and repaired by increased nourishment. This is true of all cases of tuberculosis, but particularly of the more advanced cases where the loss of body weight and the continual drain on the tissues, has been greater. Fortunately the organism seems to respond in an increased power of assimilation. The body demands more nourishment and the gastro-intestinal tract, as a rule, responds bravely. It is for this reason that advanced cases where the drain has been greatest must be overfed (though not needlessly), and it is for this reason that they can assimilate more than individuals in good health. It follows that this increased nourishment should be as non-irritating and as easily digested as possible.

In order that the gastro-intestinal tract may exercise its function of cure in these cases, it is absolutely essential that it be kept as functionally perfect as possible. Nor is this as difficult as it might at first seem. While minor grades of functional gastro-intestinal disturbance often precede and accompany the frank manifestations of tuberculosis, there is not, as a rule, any organic fault;

and this state manifests itself in mild symptoms consisting principally of poor appetite, flatulence and possibly distress and distention after eating, associated with constipation. They are, in other words, the result of stagnation and fermentation, from a mild grade of motor and glandular insufficiency.

From the evidence at hand, which is rather scanty, there seems to be no one condition of gastric secretion characteristic of tuberculosis. In some cases there is diminution of glandular activity with reduction of the hydrochloric acid and pepsin secretion, while in others a hyperchlorhydria obtains. This is true even of advanced cases. But in association with the motor insufficiency which is often present, and is really a manifestation of the general muscular relaxation and weakness, the perversion of glandular function in either case gives rise to symptoms of fermentation.

The gastro-intestinal function is not, as a rule, profoundly disturbed, though it may be readily upset by too much or unwise medication. But with care, it is remarkable how ably it responds to the increased demands made upon it. I have made a careful study of the size and position of the stomach (and transverse colon) in all my cases, and very rarely, except in multiparous women, is it dilated or ptosed. On the contrary, particularly in advanced cases, one often finds a reduction in the size of the stomach. At autopsy in ad-

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vanced cases it may sometimes be found quite small, lying in a more or less vertical position under the left costal margin. These cases have usually, though not always, shown an inability to ingest or assimilate adequate amounts of nourishment, not only from want of appetite but also from motor insufficiency. On this account such cases are apt to prove difficult to nourish and the outlook is less favorable. One must attribute this deterioration in gastric function to the advance and prolonged course of the disease, but there is soon set up a vicious circle in which the gastric condition reacts on the pulmonary condition.

The manner in which drugs should be exhibited to be as readily borne as possible, and the character of the comparatively few drugs which are of service, have been sufficiently emphasized above. It remains to consider the general principles of the treatment of gastric disturbance.

Rest and fresh air are in themselves most important aids to digestion in tuberculosis. It is not at all uncommon to have quite marked dyspeptic symptoms disappear completely when the proper regimen is instituted.

When the stomach rebels in the course of the usual milk and egg diet, as sometimes happens, it is much more likely to be due to some other factor than the milk and eggs. This should be looked for in other articles of diet which the patient may be taking. Many patients can take a full milk and egg diet but not other food in addition. Fruit

will sometimes upset a patient temporarily. I have known of cases where even an orange sufficed to do this. It does not follow that fruit is a bad thing, or that it should not be permitted. The patient who cannot digest an orange may enjoy and assimilate perfectly a pear. If there is evidence of flatulence or distress, the midday meal should be modified or cut out altogether. Other articles of diet should be cut out or diminished before any reduction is made in the essential elements of the diet.

Sometimes it is necessary to diminish the amount of milk or the number of eggs, but it must always be borne in mind that there is no type of food so nourishing and so easily digested. Therefore if milk and eggs are given up or even reduced, we are at a loss where to turn for suitable nourishment.

If a patient's symptoms of indigestion are not relieved by cutting out solid food, the character of the milk and the freshness of the eggs should be looked into. Eggs which are not perfectly fresh will frequently upset digestion. The same is true of milk, and here there is the additional factor of bacterial contamination. Milk with a high bacterial count is frequently responsible for gastro-intestinal fermentation and diarrhea. Certified milk should be obtained, and where this is not possible, it is better to have the milk pasteurized, at least temporarily—if there is reason to suppose that the gastric symptoms result from

its contamination. The greatest cleanliness should be exercised in milking (the hands of the milker and udder of the cow being carefully cleansed) and the receptacles for the milk carefully sterilized. All such details are very essential, and the want of them is often responsible for gastric disturbance. In cases with weak digestive power, it may be necessary to add a tablespoonful of lime water to a glass of milk, or to dilute it slightly with vichy or other carbonated water. Sometimes the milk is more readily digested when taken slightly warm. Where there is diarrhea it may be given boiled. Whole milk, if very rich, may in some cases prove too much for the digestion. Its richness should be reduced by removing a part of the cream. All these manoeuvres must be gone through with in the hope of discovering and obviating the source of the fermentation.

For flatulence and distress after taking food the best and most effective drug is creosote in small doses. This may be given in half or one minim doses, in water, three or four times a day, or in the following prescription:

R Creosoti (pure beechwood) ℥ xxiv;
 Sodii Bicarb. ʒ ij;
 Acacia,
 Syrupi, āā q. s.
 Spiritus Levandulæ Comp. f ʒ ij;
 Aquæ Puræ ad f ʒ iiij.
 M. et sig. f ʒ j after meals and at bedtime.

Another very effective mixture of the same character, particularly where there is constipation, is the following:

R Acid. Carb..... ʒss;
 Lac. Magnesia,
 Aq. Menthæ Viridis āā fʒ jil.

Sig. One or two teaspoonfuls in a glass of hot water
 half an hour before meals and at bedtime.

For flatulence or pain, particularly in hyperacidity, aromatic spirits of ammonia is a very useful drug in doses of fifteen minims to half a drachm, in water. It also has the advantage of being a good stimulant.

Hydrochloric or muriatic acid is much used for the milder disturbances of digestion and also to stimulate the appetite. It is particularly indicated with fermentation and anorexia. It acts primarily as an antiseptic, though being the normal acid of digestion, it serves a useful purpose in replacing this when it is deficient. It should be given in the form of the dilute acid, Acidum Hydrochloricum Dilutum (10 per cent.), in sufficiently large doses. I sometimes prescribe it in a half glass of water, as much acid being added as can be comfortably taken without burning. This will usually be about fifteen to twenty drops. The official dose is from ten to thirty drops.

It is well combined with strychnia, the bitter tonics and the aromatics. The following are useful combinations:

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R Acidi Hydrochlor. dil. f 3 ij;
 Pepsin Essence..... f 3 j;
 Tinct. Gent. Comp.....q. s. ad f 3 iv.

Sig. Dessertspoonful in a little water with meals.

R Acidi Hydrochlor. dil.,
 Acidi Phosphor. dil.....āā f 3 ss;
 Pepsini..... 3 ij;
 Strychninæ Phosphatis..... gr. jss;
 Tinct. Cardamomi Comp.....ad f 3 vj.

Sig. One or two teaspoonfuls before or after meals.

R Acid. Hydrochlor. dil.,
 Acid. Phosphoric. dil.....āā f 3 ss;
 Pepsini..... 3 ij;
 Tinct. Nucis Vom. f 3 ss;
 Tinct. Cardamomi or Elixir Calisayæ.....ad f 3 vj.

Sig. One or two teaspoonfuls before or after meals.

Nausea and vomiting must be treated on general principles. The diet must be at once reduced or modified. If any drugs are being used and the disturbance can in any way be attributed to them, they should be omitted. Nothing can be accomplished in the treatment of tuberculosis until the gastro-intestinal function is restored. The quantity of milk should be cut down, and lime water added. It should be taken very slowly. The patient should be confined to the recumbent position if the nausea is very marked or there is much vomiting. A mustard plaster or ice-bag to the epigastrium may afford relief.

Creosote (pure beechwood) in doses of a half to one minim, combined with an alkali or chalk, is extremely valuable in nausea or sick stomach

from fermentation of the contents of the stomach or bowels.

Another drug acting in the same way and perhaps equally effective is carbolic acid. Where there is nausea, associated with diarrhea from gastro-intestinal irritation or relaxation, carbolic acid in half- to one-grain doses, combined with bismuth and aromatic spirits of ammonia is most effective.

R Acidi Carbolici gr. xij;
 Bismuthi Salicylatis..... ʒij;
 Spiritus Ammon. Aromat..... fʒss;
 Aque Puræ fʒiij.
 M. et sig. fʒj every three hours.

In nervous vomiting with pain, or irritable stomach from hyperæsthesia of the mucous membrane, hydrocyanic acid has been used. Decided dyspeptic symptoms with pain often yield remarkably to this drug. The relief is often immediate, or is soon apparent; and if the desired result is not brought about soon, it is useless to keep up the remedy. Its action is very fugacious. The dose is from one to three minims of the official Acidum Hydrocyanicum Dilutum (2 per cent.).

Where there is much fever with a tendency to sick stomach the so-called "effervescing draught" acts particularly well. One to two drachms of the official Potassii Citras Effervescens, should be given in a glass of water, and may be repeated until the bowels are freely opened. In the treat-

ment of nausea or vomiting in tuberculosis, as elsewhere, the bowels should be kept freely open with some form of salts. The above is a very elegant method of exhibiting them, though Magnesium Sulphate, Sodii et Potassii Tartras, and Liquor Potassii Citratis are all about as effective.

In some instances, particularly where there is hypertension in the circulation, nitroglycerin in small doses will act well in controlling vomiting. It is useful where opiates have been erroneously used and are a factor in the gastric disturbance. It should be given in doses of 1-300 grain every half hour for five or six doses.

Again, where there is hypertension in the circulation aconite may be of service. Where there is considerable weakness, however, it should not be resorted to. It is well given in doses of two or three drops of the tincture in water every half hour until its effect on the pulse is manifest. H. A. Hare suggests its combination with bismuth, in the following prescription:

R Fluid Ext. Aconiti..... ℥iij;
Bismuthi Subnitrat..... ʒiij.
Ft. Chart No. 10.

M. et sig. One powder every half hour.

When the vomiting is excessive and due to irritation, cocaine may be used. It is serviceable in this connection as being a respiratory stimulant as well as a general tonic, especially to the circulation. It is used in the form of the official

Cocainæ Hydrochloridum in doses of 1-24 to 1-12 grain. It may be well combined in the following manner:

R Bismuthi Salicylatis,
 Pepsinæ.....āā ʒij;
 Cocain. Hydrochlor. gr. j;
 Aq. Cinnamomi..... fʒiij.
 Sig. fʒj every hour or half hour.

Stockton of Buffalo speaks highly of salicylic acid in vomiting. For this reason I always use the salicylate of bismuth when prescribing the latter drug for nausea or vomiting. Where there is constipation, bismuth, if used, should be associated with salts in order to keep the gastrointestinal tract open and free from fermenting residue.

Nux vomica is also used in nausea. It is well given in the widely used formula:

R Tinct. Nucis Vom.,
 Sodii Bicarb.āā ʒij;
 Tinct. Gentianæ Comp. fʒiij.
 Sig. fʒj every half hour.

or may be prescribed as suggested by Hare, as follows:

R Tinct. Nucis Vom..... fʒij;
 Aquæ Cinnamomi..... fʒiij.
 Sig. fʒj every half hour.

Hoffman's anodyne, Spiritus Ætheris Compositus, is an efficient carminative and a good stimu-

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lant. It may be given in sick stomach in half to one drachm doses every half hour or hour, in cold water. Aromatic spirits of ammonia is also useful in the same way. It is a good carminative and antiaacid, as well as a general tonic. It may be given in doses of fifteen minims to half a drachm every hour for several doses.

Finally, a word of caution in regard to the use of drugs to aid digestion or to control gastrointestinal symptoms. Care must be exercised that more harm than good is not done. They should only be used where there is a definite indication for them, and all other medication should be temporarily omitted until the gastro-intestinal function is restored.

FEVER.

The question of fever has been thoroughly discussed in Chapter II. It is worth while stating a few recognized facts, however. This symptom should be controlled entirely by rest and fresh air and diet. The exhibition of drugs in this relation is most irrational and harmful. Fever is rarely high in tuberculosis, and aside from the alcohol sponging recommended in the evening, which is cooling and refreshing, even hydrotherapy is out of place.

In regard to the necessity for rest and fresh air to control fever, Cornet says, "The exceptional cases in which consumptives go about for a long

time in spite of considerable fever cannot justify us in advising a measure which raises fever by furthering the absorption of the proteins. It may take months before the temperature becomes normal again. Such cases demand great circumspection and care on the part of the physician, and much patience, insight, and forbearance from the patient. Many years of experience have taught me that timely use of the rest cure gives astounding results even in old cases."

There are a certain number of cases who continue to run a low temperature from $99\frac{1}{2}$ to 100° F., even after all other symptoms may have abated or even disappeared. This is sometimes seen in chronic cases with old cavities; or in cases with weak or dilated hearts. If, after satisfactory improvement of the general condition following an adequate course of rest and fresh air this symptom remains, it is justifiable to cautiously begin exercise. Sometimes the fever in such cases under the use of gradually increasing exercise in the form of walking will entirely disappear. But should the fever be increased by this tentative course, the indication is for further rest.

NIGHTSWEATS AND CHILLS.

Of the treatment of nightsweats little need be said except in so far as being evidence of fever and toxemia they call for rest. Patients going about, running a temperature of $99\frac{1}{2}$ or a 100° F., may

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complain of slight sweats. They sometimes serve a useful purpose in arousing the first suspicion of an individual as to his condition. If sweats are marked and recur, the patient should be confined to bed. They rarely last long after the institution of the rest and fresh air treatment.

Nightsweats are not as a rule a marked feature of even advanced tuberculosis. Where they do occur with the patient in bed, the limbs and body may be bathed at night with alcohol and water and thoroughly dried. Alum added to this solution in the proportion of two grains to the ounce, increases its efficiency.

Atropine in dose of an eightieth to a sixtieth of a grain given hypodermatically an hour before the sweat occurs is sometimes effective. Hare speaks well of camphor and recommends 15 to 30 grains of the official *Acidum Camphoricum* in capsule or cachet an hour before the sweat. If the sweat occurs late in the night, the dose may be divided, the patient being aroused to take the second dose. It is rapidly eliminated by the kidneys, the whole of a single dose being eliminated in about five hours. Camphoric acid, while effective at times, is irritating to the stomach. The spirits of camphor, which is less irritating, may be tried in dose of 15 to 30 minims, as above.

Arsenic has also been recommended, and Cornet, following Szekely, recommends the following:

R Liq. Potassii Arsenitis,
 Tinct. Belladonnæāā ℥v;
 Aq. Puræ f℥ss.
 M. et sig. Fifteen to twenty drops at 6 P.M.

Sulphuric acid combined with belladonna has also been used, and many other drugs, but when we consider that night sweats are only an evidence of the activity of the local process acting on the nervous system through the production of toxins, it seems irrational to prescribe internal remedies to relieve this symptom. The relief thus brought about accomplishes little, except in the comfort afforded the patient. The proper method of controlling them is to abate the activity of the local process, and this can only be done by a proper regimen. As soon as this has been instituted, particularly if the patient can be put to bed in the open air, the night sweats and chills, with the other evidences of toxemia, will be greatly reduced at once and will soon disappear entirely.

After a night sweat the patient may be made more comfortable by an alcohol rub and a change of clothing. If the bed clothes are wet, as is usually the case, they should be changed also.

Chills, like night sweats, are evidences of fever and toxemia, and do not as a rule require internal medication. They will cease to occur or to be a factor after the institution of rest and fresh air. The alcohol sponging recommended for night sweats is also of service in chills. Sometimes nitroglycerin, if indicated for other reasons, will

act well. Digitalis has also been used for this purpose, where the circulation is feeble and the cardio-vascular system relaxed. Powell and Pollock recommend the use of arsenic for the chills or chilly feeling in tuberculosis. I have only used it, with this as a secondary purpose, where it was indicated for other reasons. There is no objection to administering a cup of hot milk or coffee, and keeping the patient warm, if a chill is anticipated or chilliness complained of. A dose or two of aromatic spirits of ammonia may also be used. Alcohol frequently recommended in this relation should not be used.

PAIN.

The pains in the chest complained of by tuberculous patients are usually due to pleurisy. As such, if mild, they are not serious, except in so far as they may indicate a fresh cold. They should be relieved by local measures. Strapping the affected side is an effective measure. Tincture of iodine or a mustard plaster locally will afford relief in the milder cases. Dry cups or a blister are also serviceable. For pain in the back or in the chest wall or in the abdomen from coughing, I often use the following ointment:

R Methyl Salicylatis..... ℥ij;
 Oleum Terebinthinæ ℥xx;
 Lanolin..... ℥ij.

Sig. Rub in thoroughly ten or fifteen minutes and repeat.

Iodine inunctions of the solution of eucrophen in olive oil are also of service. The coal-tar products and morphine should not be used.

HEADACHE.

Headaches arise sometimes from definite causes, but often they belong to a class of symptoms which require tact rather than medication on the part of the physician. In any event the first drug to be thought of is magnesium sulphate. If the headache results from slight gastric disturbance and constipation, this will be all the medication required.

Headaches are sometimes an evidence of the neurasthenic state or of weakness. In such cases strychnine in full doses over a considerable period of time will effect a cure. Or, if the general condition of the patient warrants it, small doses of the bromides are permissible. Where a sedative is needed the bromides are the best drugs. They may be advantageously associated with strychnia, or with aromatic spirits of ammonia, with a view to counteracting their depressing effect.

If headache results from cerebral congestion and is associated with high arterial tension and overaction of the heart, nitroglycerin or aconite in small doses will often afford relief. The bromides may be used here also.

Hot mustard footbaths, or a mustard plaster, small blister, or dry cup applied to the nape of the neck will often relieve engorgement of the cere-

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bral vessels. Blood letting may be tried by applying leeches back of the ear, or a small wet cup to the nape of the neck. An ice-bag may be applied to the head.

H. A. Hare suggests the following lotion applied to the top of the head in nervous women:

R Spts. Camphoræ..... f℥j;
 Spts. Lavandulæ,
 Alcoholisāā f℥ij.
 M. et sig. Apply locally to head.

or

R Camphoræ,
 Oleum Menth. Pip.....āā ℥j;
 Chloroformi f℥ss;
 Alcoholisq. s. ad f℥iij.
 Sig. Shake bottle and apply a little to the head.

Cologne water, to which 5 grains of menthol to the ounce has been added, applied to the head and forehead, will sometimes relieve headache.

In bad, nervous headache, caffeine citrate in 5-grain doses, repeated once or twice, will often afford relief, or spirits of camphor in 10 to 20 minim doses. Hoffman's anodyne and aromatic spirits of ammonia may be used in the same manner. The coal-tar products are not to be used except under compunction, but a mixture of acetanilid, caffeine and soda, or acetanilid, caffeine and sodium bromide will relieve nervous headache, but is of doubtful value in tuberculosis, as it is depressing and may upset digestion.

The following combination may be suggested as effective, but like the above, should only be used under compunction:

R Sodii Bicarb.,
 Sodii Bromid.,
 Acetanilid.....ãã gr. xxiv ;
 Cocaine gr. ss.
 Div. in cap. No. xxiv.

Sig. One every hour for two or three doses.

Headache results sometimes from eye-strain, from the direct sunlight or from over use of the eyes in reading. In the former event, tinted glasses may be worn, and in the latter reading must be interdicted. Women should be encouraged to amuse themselves by coarse sewing and knitting.

Finally, sleep may be recommended as often bringing relief, particularly in those cases where there is mental anxiety or in the highly strung, nervous or fatigued.

The physician will do well to ignore all headaches which are not severe or which do not influence unfavorably the patient's general condition, except in so far as salts or local applications will effect relief.

CHAPTER IX.

GENERAL CONSIDERATIONS.

It takes an hour to an hour and a half to properly examine and outline the management of a case of tuberculosis at the first visit. This should be explained to the prospective patient and a special appointment made. It is impossible to examine properly a case of tuberculosis with an office full, or even three or four patients waiting their turn. It is only by giving ample time and by following some such method, that a physician can do justice to these cases and establish a proper relation with his patient.

If a prospective patient is not satisfied to make an appointment and to keep it, your loss is not serious, as he is of a type to profit little by and reflect little credit on your treatment. Tuberculous patients will come to you, either because they have been sent by other patients, or because they know of you by reputation—in either event it is *your* opinion which is sought and they come with a serious-minded point of view and recognize that the wait of a day or two, if this is necessary, means nothing to their condition, yet a great deal in the advantage of your careful study.

A patient's return at the appointed hour is in

itself a guarantee of his serious purpose, and his willingness to second your efforts in his behalf.

The examination and prescribing for a tuberculous patient is a very different matter from routine office work and requires more detailed study. It is impossible to properly manage a case unless the diagnosis is clear in your own mind. It is well to tell the patient frankly his condition, and explain fully the possible dangers of his case. This is not with the idea of alarming him, but of giving him a more complete understanding of what to avoid; and in securing his confidence and co-operation. Without these you can accomplish nothing; with them you can reap whatever possibilities his case presents.

As Bonney says in this relation: "Following a review of the clinical history and exhaustive examination of the chest, it is my practice to make a brief report of the condition and offer such encouragement as is consistent with the facts, and seems advisable from first impressions, declining, however, to grant a detailed advisory statement until after the urine and sputum have been examined. This permits not only precise clinical information regarding some important phases of the case, but what is even more important, affords not less than twenty-four hours' delay, during which time its many aspects may be reviewed. I have found it desirable in the majority of instances to acquaint the patient and family with some intelligent conception of the nature of the

disease and the manner in which it is hoped to secure arrest. . . . Having thus established early relations of confidence and reciprocal effort, the physician is usually permitted with less opposition to elaborate ideas of treatment which might otherwise have been non-acceptable to patient and friends."

I should strongly advise those anxious to study properly their cases and do the fullest justice to them, to consult and follow some good printed history chart, like that in use at the Phipps Institute (Second Annual Report), not only in taking the clinical history, but also in making and recording the physical examination. This chart was elaborated after much study and discussion, and represents as nearly complete and perfect a record as may be arrived at for practical purposes. Its clinical side embodies the data required for a thorough understanding of the case, not only in relation to diagnosis but also prognosis and treatment. It is well to have such a chart copied for private use and to regulate and systematize one's methods of study by it. It is also essential to have a printed set of rules such as is also used at the Phipps (Second Annual Report) or the more elaborate code in Dr. Minor's "Hints and Helps" (see Chapter XI), for distribution to every patient, and their guidance subsequent to the first visit.

It is most important that a careful and complete examination of both sputum and urine be made

repeatedly in relation to treatment. The report on the sputum should include not only the presence or absence of large or small numbers of tubercle bacilli, and any morphological or tinctorial characteristics they may possess, but it is most important that the character and virulency of the mixed infections, if any are present, be thoroughly understood.

The data obtained from the staining of cover glass smears, while valuable for routine work, is not adequate where all the possibilities and problems in a case would be completely understood. A complete bacteriological report when possible should be made, showing the results of culture products and animal inoculation. Then the physician is in a position to know whether he is dealing with a streptococcic or a pneumococcic infection, or both, and what the virulency of the growth is. A thorough knowledge of this data is important in relation not only to treatment but to prognosis. So long as a virulent growth of pneumococci are found in the sputum there is always danger of fresh outbreaks of hemorrhage, no matter how good the general condition of the patient nor how well he may seem.

A knowledge of the condition of the kidneys is also most important. They are particularly exposed to destructive changes from their eliminative function; changes brought about not only by the passage of tubercle bacilli themselves, but from the elimination of toxins. Walsh has shown

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how frequently the kidneys are the seat of a miliary tuberculosis or a toxic nephritis. Albuminuria and tube casts are not always pathologically significant, but it behooves the physician to watch these important organs and to conserve them so far as may be in his treatment. Death in advanced tuberculosis is much more frequently due to organic disease of the kidneys than is generally supposed.

A complete urinalysis includes, in addition to the ordinary tests for albumin and sugar and a careful microscopical examination after centrifugation, the tests for indican and the diazo reaction. A report on the presence or absence of tubercle bacilli is often extremely significant.

It would naturally be quite impossible to differentiate between the different types of cases representing themselves in relation to treatment. Nor is this necessary. No hard and fast rules can be laid down; every case must be treated individually; but general principles must always be recognized and followed. In his discussion of treatment with a patient, the physician must always remember the primary importance of advice in regard to prophylactic measures. The patient must never swallow his sputum, and he must be told how to destroy it. He must always sleep alone, and the sources of danger in his private and public relations must be fully explained to him. The exercise of a little care on his part will render his presence at home and

abroad innocuous to everyone. A consumptive who is immaculately clean is not of any danger even to his immediate associates or surroundings. He should be warned against close personal contact, as this may bring colds and coughs to him, and may give others consumption. His breath is sterile, but he should be careful to hold a paper napkin to his mouth when sneezing or coughing, as the small particles of mucus thus projected may contain live bacilli.

It is important that he be advised as to the selection of a bright, airy room, or as to the possibility of sleeping out of doors on a porch or roof.

Should the patient have a temperature over 100° F., accompanied by rapid pulse and other clinical evidence of an active local process, he must be sent home to remain in bed and be treated there. Patients who are in the more advanced stages of the disease, with much loss of weight and strength, and a loose productive cough, are also better off in bed, even if the temperature is not high. The best results cannot be gotten in cases of this latter type in office practice. Even though a case is in condition to follow a line of treatment from regular visits to the office, it is still advisable to pay at least one visit to his home, and study and arrange the local conditions for him.

Incipient cases or those suitable for office treatment should as a rule be at once put on an increased diet. Where the disease is very mild and there has not been much loss of weight, this may

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consist in a glass or two of milk at breakfast and supper, and the same between meals. But, as a rule, if there is considerable loss in weight two quarts of whole fresh milk and three eggs is a minimum. The question of the advantage of over-feeding, within reasonable limitations, does not admit of argument. The more advanced the case and the greater the loss of body weight, the greater must be the nourishment. The question of diet is fully considered elsewhere.

If there is weak digestion or poor appetite, I usually prescribe a 1-30 of strychnia three times a day a half hour before meals. Sometimes I prefer dilute hydrochloric acid or one of the bitter tonic mixtures outlined above. If the pulse is rapid, around 110, and there is accentuation of the second aortic sound, or if the right heart is dilated, I prescribe nitroglycerin in the form of 1 minim of the Spiritus Glycyrylis Nitratis, three (or four) times a day after meals. If there is any tendency to constipation, magnesium sulphate should be added to the above in two-drachm doses in water on rising.

The above medication is all as a rule required, and the nitroglycerin or salts are often not necessary. The true progress of the case will depend upon the skill in the management of the increased diet, the rest and fresh air, and the many (apparently) trivial details which will come up for adjustment. It is proper regimen, particularly in early cases, which counts and not drugs.

GENERAL CONSIDERATION

In treating more advanced or iller p
their homes, the principles outlined
elsewhere in these pages, should be follow
should always be remembered that the home treat-
ment of tuberculosis can be successfully carried
out in any climate, provided that home is not too
humble and the patient's resources not too re-
stricted. It remains for the physician to avail
himself of all the possibilities of a particular
home, and in his ability to transform unfavorable
to favorable surroundings, will lie a large measure
of his success. In the selection of his room, in
the removal of superfluous hangings, window cur-
tains or drapery, in the adjusting of the bed
clothes to the temperature, in providing for the
maximum amount of sunlight and fresh air, in
attention to the cleanliness and promptness of his
service, in many of the details which seem to count
for so little, lie the elements of success. It will
not do for the physician to yield to the prejudice,
ignorance, or whim of a patient or his family.
The physician's wishes must be their law, and
from the moment his dictum is not observed, his
usefulness wanes. He should explain fully the
reasons for his course, and may well tolerate ques-
tioning and discussion, so long as this does not
take the form of passive resistance. If the physi-
cian is not ably seconded by the patient and his
family, and has not their entire confidence, he can
accomplish little. The moment a physician finds
that his directions are not being carried out, par-

ticularly in the more essential details, the sooner he retires from the case the better for himself. This does not often happen, indeed would be a most exceptional occurrence, but this principle should be borne in mind. For myself I would not treat a case, speaking particularly of private patients whose financial circumstances make successful treatment possible, who did not follow, or even enlarged, on my instructions in one single iota of the course. This is not a plea for narrow-mindedness, but for consistency. I would not refuse to discuss fully the situation and might be influenced by circumstances in a particular case, to change my course somewhat. This decision would not be influenced by the whim or ignorance of the patient, however; but there are times when an intelligent patient can be of material assistance in regard to certain minor details.

Tact is a most essential quality in a physician. It is particularly so in tuberculosis, where the disease is so chronic, and the treatment so protracted as to be, relatively speaking, very irksome to most patients.

The kind of medication outlined in the early part of this chapter for ambulatory cases is also the best for those confined to bed. The latter will require, however, more feeding, as their loss of weight and strength has been greater. This element in the treatment cannot be too strongly emphasized. It is because the general practitioner does not fully understand the question of

feeding tuberculous patients that his results are not better.

If there is much cough with mucopurulent expectoration, creosote, as outlined above, should be instituted. Patients confined to bed find judicious sponging with alcohol and water very grateful. It should be done carefully so as not to expose them unduly, and only once a day, in the evening. This is particularly useful where there are night-sweats. Where the patient so desires he may also be sponged with soap and water in the morning, care being exercised not to wet the bed clothes nor to expose him. One limb at a time should be gently washed and carefully dried. Unless patients have had a recent frank outbreak of hemorrhage they may be permitted to use a commode or an adjoining toilet. In the latter event, a bedpan should be used.

As a routine application to the throat, nothing answers so well as euophen in solution. Iodine, like creosote, seems of great value in many cases, and local application to the pharynx night and morning, and the daily inunction of a drachm of the euophen solution should be persisted in over a long period.

Gastro-intestinal disturbance and other symptoms must be treated (when they require treatment) as they arise according to the principles and practice laid down elsewhere.

Ambulatory cases should be seen regularly at least once a week, certainly never less than once

every two weeks. In treating a patient at home, the physician must be guided as to his visits by circumstances, but, as a rule, once every week is sufficiently often to see the patient.

A consumptive of small means should during his convalescence, which is preferably carried out in some sanatorium in the country, be encouraged to do a certain amount of work daily, as soon as his condition warrants it. It is not enough to cure these cases in the sense of arresting the disease, but they must be prepared for a life of usefulness, and restored to such a condition that they can again take up their work. Often the original occupation will be too confining or trying to be again taken up. They should then be advised as to the kind of work which they can do. At the Free Hospital for Poor Consumptives at White Haven, for instance, the patients, with this end in view, are required according to their physical progress and condition to do four, six or eight hours of light work a day. This is of great advantage in hardening their muscles and endurance, and improving their general condition to a point where they can successfully return to work. Throughout this course they gain steadily in weight, and while they do not gain as rapidly as though loafing, yet they are not so likely to lose what they have thus gained.

Incidentally this prevents the development of habits of slothfulness, which rapidly unfits many for regular employment; and it also serves a

useful purpose in relieving ennui and keeping the mental viewpoint bright and hopeful of the future.

A tuberculous patient must, if he would get well, observe early hours and good habits during his convalescence. Simple and reasonable amusements and pleasures should not be interdicted. Smoking in moderation, provided he does not inhale and his throat is normal, may be indulged in. This, however, only after he has reached a stage where the disease is practically arrested. The same may be said of drinking—a glass of beer, or light white or red wine can in no way be injurious. It is the abuse, not the use, of the good things of life which he must avoid.

In regard to sexual matters, he should follow a sane and reasonable course. Absolute continence after the cessation of the progress of his disease is not necessary, nor perhaps even wise, unless it may have conformed to his previous manner of living.

While as a general dictum it may be best to say that the marriage of tuberculous subjects should be discouraged, this is hardly fair to them nor is it necessary in the light of the consequences. Many men and women in whom the disease has been arrested have married, and been the parents of strong, healthy offspring, without relapse or deterioration in their own condition. As long as there are signs or symptoms of the active process, however, or until the disease is completely and satisfactorily arrested, marriage is impossible for

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either man or woman. Not only is there the danger of infecting the husband or wife and a weak tuberculous offspring resulting, but the danger to the tuberculous subject himself or herself is even greater, for they usually suffer such deterioration of their condition as to eventually succumb to the disease.

Pregnancy, with its tremendous drain on the health and strength of a woman, affects most unfavorably the tuberculous process. The relative loss of weight (aside from the growth of the fetus) is usually rapid and very great, and even if the course of the puerperium is uneventful, it frequently causes a rapid lighting up or spread of the lesion in the lung—unless this is sufficiently arrested. Conception is to be strongly discouraged in tuberculous women, unless the lesion is so well healed as to be practically cured. Even then, pregnancy and childbirth often light up the process and give rise to the disease in its most acute and fatal form. As Cornet well says: “But after there has been a relative recovery, when the *symptoms* have been in abeyance for *two or three years* and the patient maintains a satisfactory general condition, I believe that we have no right to forbid marriage. If a man is fairly well-to-do and if his wife makes no very severe demands upon him, he ordinarily has far more comfort and rest and better care in the married state than as a bachelor. On the other hand, a woman may be seriously harmed by marriage with all its con-

sequences, especially the puerperium, unless she has been thoroughly toned up. For the sake of the offspring, permission to marry should be withheld not only until the patient has made a relative recovery, but until the general condition is satisfactory."

Finally, tuberculosis is unlike most diseases, in that, of it may be truly said—once tuberculous, always tuberculous. Very few, indeed, are the cases who can consider themselves as robust subsequently as a normal individual and who can afford to take the risks of fatigue and exposure which mean little to the latter. The widest usefulness and activity, however, are not denied those in whom the disease has been satisfactorily arrested. Some of the most distinguished and useful of our profession have at one time been victims to it. Such a history is not incomparable with an active social and successful business career, but the disease imposes limitations of exposure and endurance short of what would have been the unaffected condition of the individual. Even years later, some indiscretion like a wetting to the skin, by setting up an acute congestion of the lungs or a pneumonia—or some over-exertion like running or heavy lifting or tennis, by snapping a vessel; may give rise to fatal hemorrhage from rupture of an aneurism in an old healed cavity.

The individual who has once had tuberculosis will always have to be on guard against his old enemy, no matter how well he may get and no

matter how long ago it has been. There is more or less danger according to varying factors—but there is always *some* danger. Such an individual will always have to keep his weight up and to look with suspicion upon anything which affects his health in general or his respiratory tract in particular.

CHAPTER X.

PROPHYLAXIS.

THE prophylaxis or prevention of tuberculosis is so essentially related to the treatment, that a discussion of this phase of the subject is called for. Some of the details in this chapter have been referred to elsewhere above, but it seems best to present the subject in its entirety. People everywhere are alive to the preventable character of this disease, and never before has both lay and professional interest in this phase of the subject been more widespread. It is interesting to review briefly certain figures of an official character, showing the incidence of this disease. From the United States Census Reports Nos. 11 and 12, we find that in the year 1890, 102,199 people died of consumption in the United States; a proportion of over 12,000 per 100,000 deaths. In 1900, 111,059 people died of consumption; a proportion of over 10,000 per 100,000 deaths. It will be seen that over a hundred thousand lives are lost a year through this dread disease; or, to put it a little differently, one death out of every ten is caused by consumption. In fact, more people die of consumption than of scarlet fever, measles, typhoid fever, diphtheria, whooping cough, and influenza, all together. Fully 80 per cent. of the victims of

tuberculosis are in the middle period of life, between the ages of 15 and 50. Let us make a very conservative estimate, which is not as fanciful as it may seem, of the actual loss in cash of this army of sick, incapacitated from earning their daily bread. Putting the average daily wage at 75 cents, the loss amounts to \$67,000 a day; or reckoning the working year at 300 days, and estimating the individual incapacity as being for six months only, the loss amounts to \$10,000,000 a year. When to this one adds the expenditure necessary for physicians, nursing, medicine and burial, the figures become stupendous.

Cornet of Berlin gives some interesting figures on tuberculosis for continental Europe. From 1875 to 1894 the deaths from tuberculosis in Prussia alone amounted to 1,669,587 persons, which is equivalent to the entire population of Philadelphia. The average is about 80,000 a year. In Austria, from 1881 to 1892, a period of eleven years, there were 1,059,300 deaths, or about 90,000 a year. These figures represent a mortality even greater than we have in this country.

Tuberculosis is more fatal to humanity than dysentery, cholera or the plague. The ravages of war are insignificant beside it. In the great Franco-Prussian war, according to Prussian statistics, the number of men killed and dying of wounds and disease amounted to 40,951. Twice as many die each year in Prussia of tuberculosis. In our own Civil War there were 70,293 lives lost

in battle. This is only a little over half the number dying each year from tuberculosis in this country.

But monstrous as is this showing of the direct ravages of tuberculosis, it is not all nor even the worst half of the picture; for tuberculosis attacks every organ and tissue of the body and, accordingly, travels under many other names. For instance, it is called lupus when it attacks the skin; scrofula when it attacks the glands; curvature of the spine, or spinal caries, when it attacks the vertebræ; Pott's disease, when it attacks the hip; white swelling, when it attacks the joints; and so on indefinitely. Who, then, can measure the anguish, poverty, degradation and sin which it causes! Our insane hospitals and orphan asylums, our homes and hospitals for crippled children, our reformatories, prisons and penitentiaries are filled with the indirect results of tuberculosis (Flick).

With such facts and figures before us, there can be little need of discussing the advisability of employing measures to suppress this universal pest. That we should adopt all such measures as lie in our power is a self-evident fact. And when I add that we *can* safeguard against it, and that by certain simple measures we *can* cut down this awful mortality, it becomes criminal negligence on our part to neglect them.

The general indications for prophylaxis or prevention in pulmonary tuberculosis may be classi-

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fied as including two broad aims: First, to destroy the tubercle bacillus and prevent its spread in the dried state; and, second, when once it has gained entrance to the body, to eliminate it as quickly as possible, or inhibit its growth by means of the vital energies (Cornet).

Let us consider, first, the means at our disposal to annihilate the organism. The tubercle bacillus, which is the one and only cause of tuberculosis, is unable, except when cultivated artificially in the laboratory, to increase and multiply outside the body of either human beings or animals. This is partly because it requires high body temperatures, and partly because of its slow growth, as it is crowded out of existence by other micro-organisms which grow more rapidly and luxuriantly. Fresh air and sunlight destroy it. It, therefore, exists among us only from being present in (1) the secretions of tuberculous human beings, and (2) in the milk and meat of tuberculous animals. The breath of tuberculous patients does not contain the bacilli; it is sterile and harmless.

The bacillus gains entrance to the human system, first, and most frequently, from tuberculous matter given off by consumptives after it has become dry and pulverized; and the bacilli, diffused in the air, are then either directly inhaled or taken into the gastro-intestinal tract; and, second, from the use of infected meat or milk. Tuberculosis is sometimes directly congenital and hereditary.

Infection from the use of tuberculous meat or

milk is not likely to occur where there is careful inspection of dairies, slaughter houses and herds. It is also guarded against by cooking the food. The great omnipresent danger lies in tubercle bacilli floating in the atmosphere of contaminated places, halls and rooms of dwelling houses, factories or other poorly ventilated buildings, which have become infected by expectoration of tuberculous matter. Other excreta may contain tubercle bacilli. It may be given off from the drying of feces, of pus from areas of tuberculous suppuration, from particles thrown out in the act of coughing; but these are all negligible quantities compared with the all-important source of infection in dried sputum.

Before proceeding, however, with the prophylaxis of the individual, let us for a moment consider the interest of the state in tuberculosis. We have seen from the statistics which have already been given that this matter is of such vital interest and of such widespread importance that, without aid from state and municipal authorities, the profession, even seconded by an intelligent public, is powerless to stop the spread of this scourge. We, therefore, turn, as we have every right to do, to those bodies politic which assure to each and every one of us life, liberty and the pursuit of happiness. The only question to be asked is, How can the state help in this crusade? It can help in three most important and effective ways: (1) By establishing sanatoria for the segregation,

treatment and employment of those cases which are too poor or ignorant to take care of themselves and in whose carelessness, squalor and filth lies the chief source of infection. (2) By rendering effective financial assistance to free, private and corporate sanatoria already in existence. (3) By requiring the registration of every case of tuberculosis within its confines.

The state sees and performs wisely its duties in protecting us from the spread of smallpox, scarlet fever, diphtheria, typhoid fever and other contagious diseases, the yearly ravages from which are not individually one-tenth of, and in the aggregate do not equal, the mortality of tuberculosis. Why, then, should it not in certain simple, timely and reasonable ways see its way clear to these more urgent measures! There should exist in all states adequate sanatoria accommodation for the tuberculous poor of the commonwealth. Whether this can be done by free institutions founded and maintained by the state, or by free private institutions fostered by state aid, is an open matter of dispute. These free sanatoria should be placed in suitable localities in different sections of the state, and should, of course, be under expert medical and sanitary control. There are at present in Pennsylvania, counting city institutions as well as those in the country, at the most 1,000 free beds for consumptives. The present need is for at least five times that number. One has only to turn to the records of existing sanatoria to see

the splendid results achieved. Both private and state aid should be freely given to such institutions, for their expenses are always very great. Their cottages and tents are always filled, and they have demonstrated that this is the best and most effective treatment we have to-day for a large class of cases.

In public or state sanatoria, did they but exist, or in free sanatoria supported by private charity, could they be enlarged and given increased means, the afflicted poor who infest our slums and die miserably by the hundreds could receive the care and treatment they require. What a gain to them! What a gain to humanity at large! It is these overcrowded lodging houses and tenements in the poorer sections of our cities, plague spots, which furnish the ever-present foci and source of the disease!

For tuberculosis is pre-eminently a house-bred disease. It is not contagious in the ordinary acceptance of the term. In the vast majority of instances it is contracted from living in a room or a house which has been previously contaminated or is being contaminated by the carelessness of a consumptive. It requires a prolonged exposure for a successful implantation or inoculation with the tubercle bacillus. There is little if any danger in transient association with consumptives, or from transient exposure to contaminated places. Physicians are in little danger from their examination of and attendance on the tuberculous sick.

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You cannot contract consumption from riding in a street car, nor even from sleeping a night or two in a berth on a railroad train or boat which has been previously occupied by a consumptive. All such ideas of the danger of consumption come of ignorance and exaggeration.

But it is the plague-infested areas of the slums which keep the disease continually alive; the filth and overcrowding, the squalor and starvation, the small tumbledown houses and the dirty tenements in which the really poor live; the cheerless, ill-ventilated rooms, the dark, narrow halls which furnish the fertile soil for the disease. How long does it take one or two consumptives to contaminate a whole house? The average length of residence in one place among the poor is about two or three months. How long would it take anyone coming into such quarters to contract the disease? Is it any wonder that with these ever-present foci of infection, tuberculosis numbers its victims by the tens of thousands, and that the ranks of this great army of death are always filled?

The period at which consumptives are most dangerous to their families and to the community is when they are far advanced in the disease and are very ill. Then it is that, while expectorating a great deal, they are too ill or careless to take the precaution of destroying their sputum and so guarding others from its dangers. It is especially at this time that they should be removed from their squalid surroundings and placed in city insti-

tutions. Sanatoria are necessarily limited to incipient or moderately advanced cases, which will get better in from three to six months, and they must be supplemented by city hospitals for advanced dying cases.

It is in this latter way that the very limited number of tuberculous wards of hospitals do such a great work, not only in arresting the disease in apparently hopeless cases, but in taking these cases away from their filthy surroundings just at the time when they are most dangerous to others.

In this connection dispensaries for out-patients or ambulatory cases should also be mentioned. They, too, are most potent factors in the restriction of the disease; because, aside from the benefit patients receive from treatment in dispensaries (and this is very great), they are also taught how to take care of themselves and protect others from infection.

Finally, just a word about registration. It is absolutely essential for the authorities to know the location and distribution of these cases in order that they may carry out disinfectant measures where such are necessary. It is not with the idea of making outcasts of these afflicted poor, but rather with a view of preventing them from becoming such. These cases among the ignorant should be protected from the isolation and neglect to which an unreasonable fear of their condition often subjects them. Registration would not

mean municipal interference with private rights or personal liberty, but would enable urgent measures to be taken to clean and disinfect the houses and localities in which the disease is thickest, and to educate the householders themselves as to the real source of the danger.

The interest or duty of the *individual* in prophylaxis concerns us even more vitally than the duty of the state in this regard. It is here that each and every one of us has the opportunity, and our duty is plain, to help along this great crusade. The keynote of what I shall say in regard to individual prophylaxis lies in the fact that the tuberculous person is himself the origin and source of the danger, and that it is well within his power, by the exercise of a little care and a few simple rules of hygiene, which will in no way interfere with his comfort, to control absolutely the spread of the disease from himself (Cornet).

As hinted above, the most important element in private prophylaxis is the absolute destruction of tuberculous sputum. It is absolutely essential that it should not become dry and pulverized, thus permitting the bacilli to be disseminated in the air. Tuberculous sputum is, as a rule, enveloped in a viscid bronchial mucus, which contains the bacilli in enormous numbers and retains them as long as it remains moist. When it dries, however, and becomes pulverized, as is apt to occur when it is expectorated on the floor or into handkerchiefs or rags, millions of bacilli, death lurking in

their presence, are disseminated in the air. The danger from the drying of sputum is much more imminent in closed or poorly ventilated places. The bacilli may be directly inhaled as they float in the atmosphere of the infected room or house, or may settle in the dust to be later stirred up and inhaled or carried directly to the mouth by contaminated hands or food and so ingested into the stomach.

Is it possible to guard against this prolific source of infection? The answer is *yes*, and very simply and easily, viz., the absolute destruction of sputum. This can be accomplished just in one way, by the use of paper spitboxes and paper handkerchiefs. In this way, and only in this way, can the consumptive absolutely control the danger. When indoors, patients should without fail expectorate into these. For the street, they should carry paper handkerchiefs and a small paper bag, into which the former are placed when used, the whole being burned as soon as the house is reached. Subjects of this disease should absolutely avoid spitting into rags or ordinary handkerchiefs, as the sputum dries quickly, and this is not only a source of infection for others, but of reinfection for themselves. Inasmuch, too, as during the act of coughing, particles of sputum are thrown forcibly out, a paper handkerchief should always be held over the mouth when coughing.

The use of spittoons should be avoided, because

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absolute control of the sputum and its sure destruction is not possible under these circumstances. Spittoons lead to carelessness and are very difficult to disinfect. Unless the greatest care is used in burning the contents and the vessel is subsequently sterilized in boiling water, the spittoon is more apt to be a source of menace than of security. Another objection lies in the difficulty of expectorating precisely into a spittoon and not onto the rim or surrounding floor or carpet. One has only to note the condition of cuspidors in public places frequented by men, to appreciate the significance of my remarks. Indeed, they are worse than useless and predispose to infection.

The importance of destroying the sputum cannot be exaggerated. Cornet says: "According to my experience, bacilli are found in the immediate environment of consumptives only in case they make use of handkerchiefs or spit on the floor, and never under other conditions." This is an important statement when one considers that Cornet is one of the greatest authorities in Germany on tuberculosis and was the first to demonstrate the presence of tubercle bacilli in the dust of rooms and wards occupied by tuberculous patients.

A consumptive's sputum is not only dangerous to others, but to himself. By inhaling fresh tubercle bacilli or swallowing his sputum, fresh foci of infection are set up. He cannot be too careful on his own account, and it is a

good plan for him to wash his mouth and hands thoroughly before taking food, in order that no stray particle of sputum may be carried into the stomach. On this point Cornet says: "The tuberculous person lives at the centre, as it were, of the infectious circle which he himself creates, and so imperils himself more than any other. He really commits a slow suicide by carelessness."

Physicians should discourage the marriage of tuberculous persons. A wife or child occupying the same room with a tuberculous husband or father is almost sure to contract the disease. An individual, the subject of tuberculosis, should occupy a room alone.

Physicians and others should wash their hands thoroughly after examining or being about tuberculous patients. Nurses who have to do with these sick cannot be too careful not to carry their hands to their lips. It is a good plan when in an infected room or house to breathe as much as possible through the nose.

The bedding, towels and clothing of tuberculous patients should be frequently changed, and when soiled put into boiling water or disinfected by live steam. The vessels of the toilet or table articles should be thoroughly disinfected in boiling water.

The use of disinfectants other than fire, boiling water and steam is unsatisfactory and incomplete. Powdered lye may be used to put on sputum which has been expectorated on the floor. It does not destroy the bacillus, but dissolves and disinte-

grates the sputum mass and enables it to be taken up with soap and water. The best disinfectant for the hands is soap and water and a stiff scrubbing brush. In a general way, it may be said that solutions of carbolic acid or corrosive sublimate are useless for the hands, as they are when applied directly to the sputum. They serve only to incase the bacilli in a firm albumin coagulum from which they eventually emerge on drying, as lively as ever. Chlorinated lime and the milk of lime are useful to mix with contaminated excreta, and whitewash is a good disinfectant applied to the walls of a cellar. For the purpose of disinfecting rooms, however, the best agent is, first, thorough cleansing, followed by formaldehyd gas. Formaldehyd in solution, while inferior to lime, is also useful. We are thus reduced to the following measures or solutions: (a) General measures—fire, boiling water, steam, formaldehyd gas. (b) Local measures—absolute cleanliness, soap and water, lye, chlorid and milk of lime and formalin.

Bedrooms and sitting rooms of tuberculous persons should be frequently aired and have all the sunlight possible admitted. They should not be dusted, but the walls and furniture should be wiped down moist. They should not have curtains at the windows, nor unnecessary hangings or drapery of any kind. The floors should be bare or only covered by rugs, and the windows, except in very cold or wet weather, should be kept open both day and night. A room or house in which a consumptive

has lived and died should be disinfected with as much care, according to established methods in such cases, as if he had died of smallpox or diphtheria.

Perhaps it would be of interest to outline our prophylactic measures at the Phipps Institute. Each patient is given a sputum cup as soon as he enters the hospital and is instructed in the importance of its use. He is also carefully instructed in other details of personal cleanliness. The hospital building itself, floors, walls and stairways from garret to cellar are wiped down every morning with moist mops and cloths. Each bit of furniture and woodwork is treated in the same way, even the doorknobs are not forgotten. All bed linen, towels, wearing apparel after being used are put immediately into large bags and immersed in boiling water.

Not the least part of the prophylaxis relates to the out-patients to the daily clinics. Each patient at his first visit is given a sputum cup and paper handkerchiefs and bags for the street. In his history he replies to the following questions: How many persons in the house? How many sleeping rooms? How many beds? Do you sleep alone? Where do you expectorate when home? etc.¹ Then he is carefully instructed as to personal cleanliness and the right manner of living.

Subsequently the home of the patient is visited by an inspectress from the institute, who examines

¹See Second Annual Report.

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Tuberculosis is not, as a rule, hereditary in the sense of being directly transmitted from parent to offspring. Rarely, however, it is congenital through the mother. But, it is now recognized that children of tuberculous parents when born after the parents, one or both, have had the disease, enjoy a greater resistance to the infection than do others. In other words, you have inherited in your organism and blood a greater resistance if your father or mother or grandfather or grandmother have had consumption before you. The reason why children of tuberculous parents so often develop the disease and die is that throughout their early childhood they are subject to such a constant source of infection in the rooms of their homes.

You will reply that even when taken from home and the environment of their parents early and brought up elsewhere such children frequently die of consumption. This is true, but the answer is that they have been infected early, not with the disease itself, but with the cause of it, the tubercle bacillus; and have carried in their bodies for years, frequently in tuberculous retro-peritoneal or bronchial lymph glands, the germ of the disease. This has only awaited a favorable opportunity to break forth and infect the lungs through the lymph channels and the blood. Such an opportunity is furnished by ill health, or a bad cold, an attack of the grippe or pneumonia, and eventually they perish.

RECAPITULATION.

The most general and fatal disease of mankind is tuberculosis (consumption). One-tenth of all people fall victims to it. In America alone over 110,000 people die of it annually. The disease originates through the inspiration or ingestion of the germ of the disease, the tubercle bacillus. Infection usually occurs through the sputum, which contains millions of these bacilli. It is only dangerous when it dries and becomes pulverized and the bacilli are thus disseminated in the air. This most frequently happens when it is spit on the floor or into handkerchiefs. The drying of sputum is a source of danger not only to those who come in contact with consumptives, but also to the invalids themselves, as they are apt to reinhale or reingest the bacteria which they themselves have expectorated and thus infect healthy portions of lungs or other tissues.

Public measures for restriction and prevention :

1. The establishment of free sanatoria in the country for the treatment of incipient and moderately advanced cases, and also farms for convalescents.
2. The establishment of city hospitals for the treatment of advanced cases in the wards, and of dispensaries for ambulatory cases.
3. Registration of all cases and thorough disinfection of all houses in which tuberculosis has occurred.

4. Government inspection of dairies, slaughter houses and herds.

5. The organization of societies for the prevention of tuberculosis.

Measures for the prophylaxis of the individual:

1. The absolute control and destruction of the sputum. This can only be done if the patient spits into paper spitboxes or paper napkins, which are subsequently burned. Spittoons should not be used.

2. Care and cleanliness in the home, in respect of dust and dirt, and in disinfection of articles contaminated by use.

3. Tuberculous persons should sleep alone. The room should have no unnecessary drapery or furniture and the windows should be kept open both night and day.

Personal prophylaxis is inspired by the fact that the consumptive, if scrupulously clean, is not a source of danger even to his immediate environment. If the above directions in regard to sputum are strictly observed, association with consumptives and the care of them is ordinarily without danger (Cornet).

Tuberculosis is a scourge which can be practically eradicated through the universal recognition of the value of preventive measures by the education of the public, and when the practice of carrying them out has become general, tuberculosis will be an uncommon malady.

CHAPTER XI.

HINTS AND HELPS TO TUBERCULOUS PATIENTS.

BY CHARLES L. MINOR, M.D., ASHEVILLE, N. C.
Director in the National Association for the Study and
Prevention of Tuberculosis.

[Dr. Minor has kindly permitted me to incorporate the following rules and axioms, and I submit them with much pleasure, because in brief form they contain just the kind of information a patient needs and should follow. They are more effective and striking, too, from the terse and epigrammatic style in which they are couched.

EXERCISE.

1. None for one week after arrival, then ask about it.
2. Never to the point of fatigue. Always stop before you are tired, and don't walk "on your nerves."
3. None if your temperature the afternoon of the day before was over 99.5 degrees.
4. None if uncomfortably short of breath or if the pulse is keeping over 100.
5. None for an hour after meals.
6. None if the sputum is pink.
7. No hill-climbing without special orders.
8. No pulmonary or other gymnastics, or deep breathing, save as ordered.

9. No driving or horseback without permission—walks come first.

10. If your morning temperature is 99°, don't walk that day.

11. If you get caught in the rain while out and get wet, it will not hurt you if you keep on walking, and take an alcohol rub and put on dry clothes as soon as you get home.

12. In increasing your exercise do it by adding a very small increase each day. The Greek athlete, Milan of Crotona, when asked how he got strong enough to carry a full-grown bull up a mountainside, said he accomplished it by carrying it every day from the day it was born, the gradual increase of its weight thus was imperceptible.

REST.

1. Remember that rest comes before exercise and that the latter is only good after the former has built up your system sufficiently, so that you have a surplus of energy to draw on above and beyond the ordinary demands of your body. Until the doctor finds you have reached that point persistent unfretting rest is best for you.

2. Rest in a reclining chair if your temperature is over 99.5 degrees.

3. Stay recumbent on a cot outdoors if your temperature is over 100.5 degrees.

4. Go to bed in a room with the windows wide open if your temperature is over 101.5 degrees, and let the doctor know at once.

OUTDOOR LIFE.

1. Aim at a minimum of 8 to 10 hours spent outdoors daily, *i.e.*, 9 to 1, 2 to 6, 7 to 9.

2. If you cannot keep warm outdoors in winter, use more wraps or a hot water bag, or take a short walk, or come in for a while; *never stay out while you are chilly*. You cannot keep warm outdoors in winter if your feet are on the ground, hence you should have a proper reclining chair in cold weather at least. With such a chair and proper wraps you can soon learn to keep warm in all weathers.

3. Be out, but well protected, whatever the weather, save when it sleets; if in doubt, telephone the doctor.

4. Keep your head out of the sun; it will run up your temperature. If the weather is warm in summer, it is often best to be quiet indoors for a part of the afternoon rather than uncomfortably warm outdoors.

5. Don't sit with the wind on your back; or, if it is cold, directly in it.

AMUSEMENTS.

1. Remember that while amusements are necessary for all human beings, the person who has not the grit to deny himself pleasure for profit has not got the ability to succeed in anything.

2. Avoid amusements which subject you to dust

or to getting overheated indoors or out, for example, bowling or tennis.

3. Avoid exciting games (bridge whist, poker), or those which, like chess or an expert game of whist, demand too much mental concentration.

4. Don't keep up an active correspondence; one letter a day is allowed.

5. Avoid amusements which keep you indoors.

6. No theatre or night entertainments, save by special permission.

7. No shopping, if avoidable, and no loafing around town. *Report all trips to town.*

8. No visitors if your temperature is over 100.5 degrees. (Excuse yourself by putting the blame on the doctor; he is used to being blamed and can stand it better than you.)

9. No visiting till allowed.

CLOTHING.

1. Medium weight of wool next the skin in winter. In summer thin wool and cotton mixture or linen mesh; long sleeves are only necessary in winter.

2. Never wear heavy underclothing or chest protectors. At night put on a light undershirt underneath your nightgown. Never sleep in a nightgown or pajamas only.

3. Use stout, warm shoes.

4. Wrap warmly out of doors, *and always have an extra wrap handy.*

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5. If you get overheated and perspire, change your clothes and rub dry.

6. Never change the weight of your clothes without due consideration, remembering that

Beneath this stone, a lump of clay,
Lies Uncle Peter Dannels,
Who early in the month of May
Took off his winter flannels;

or, in the words of the wise saw, "Stick to your flannels till your flannels stick to you." It is desirable to have not only winter and summer weight of underclothing, but an intermediate for the spring and fall.

BATHING AND CARE OF THE SKIN.

1. A warm bath once or twice a week, *at bed time*.

2. A cold salt sponge bath on waking if ordered, and as ordered.

3. Stop the cold bath and tell the doctor if you are chilly or blue after it; if sick, if you catch cold, if your sputum is pink, or if the temperature on waking is under 97 degrees.

4. When taking a cold bath have your room not under 50 degrees; 60 degrees is better.

5. If you suffer from chilliness, use salt and alcohol rubs; if you perspire too freely, vinegar and alcohol rubs.

BED AND SLEEP.

1. Be in bed by 10 P.M. in summer, and 9 in winter.

2. Open windows the last thing before getting in bed, and have them closed by the servant one hour before rising.

3. As soon as accustomed to it, keep all windows open, save when hoarse or during a cold, in which case ask advice.

4. When possible it is a good thing to sleep outdoors from May until November. In special cases it can be practiced all the year, but with two or more windows to your room it is not essential even in summer.

5. Arrange your bed so as not to sleep in a draught or in a corner.

6. Use enough covers to keep warm, but avoid heavy bedding. Another mattress will often be better than another blanket. If you cannot keep warm in bed, double mattresses, or a hot water bottle, or woollen leggings, or thin flannel sheets, will help you. As has been said earlier, always wear a light undershirt next to skin in bed.

ROOM.

1. In winter, preferably but not necessarily, let it face the south, southeast or southwest; in summer preferably north, northeast or northwest.

2. Have two or more windows, and an open fireplace if possible. One-windowed rooms cannot be

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properly ventilated, unless they have a fireplace, and even then should be avoided if possible.

3. If a furnace flue opens into a room, always keep it shut tight.

4. No room-mate save by permission.

5. No bedfellow under any circumstances.

6. When in your room and not in bed let the room temperature be between 65 degrees and 68 degrees. When well covered up in bed no degree of cold will hurt you.

FOOD AND EATING.

1. The ideal food is appetizing, very nutritious and not too bulky. If appetizing, but not nutritious, it may undernourish you. If nutritious, but not appetizing, it will disgust you. If too bulky, however appetizing, it will stuff you.

2. Never burn too little coal under the boiler or you won't make steam, nor too much or it will all go up the chimney in smoke or clog the boiler tubes. Burn all that you can consume—no more and no less.

3. If your digestion is good, a generous mixed diet (favoring especially red meats, eggs, milk and fats) with a raw egg or a glass of milk at 11 and 4. If you wake in the night and can't sleep again, or if you wake more than an hour before breakfast in the morning, take a glass of milk.

4. If the digestion is poor, the doctor will give orders.

5. If the stomach feels heavy or painful after meals, if there is belching, or if the urine is muddy in the morning, you are probably overeating or your digestion needs attention. See the doctor.

6. Be regular at meals and converse while you eat. If it is good-natured talk, it will aid digestion.

7. *No eating at irregular times*, and candy only after meals.

8. *Never eat when tired*, or take exercise on a full stomach; therefore, rest a half hour before meals and be quiet for an hour after. This gives your stomach time to prepare for and do its work.

9. In twenty-four hours try to eat in addition to your regular meals from two to eight raw eggs and from four to six glasses of milk, but if it overtaxes the stomach, let the doctor know at once.

10. Eat slowly and chew well and always sip your milk slowly.

11. If you have any medicines to take at meal times, remember the susceptibilities of others, and take them in private in your room if possible.

EXPECTORATION.

1. *Never spit anywhere save in a box or pocket spittoon*, or where these cannot be used, in a square of cheese-cloth, to be kept in a special rubber-lined pocket and burned later. Such squares of cheese-cloth should be used but for one expectoration, else they will soil your hands.

2. *Always cover your mouth when you cough.*
If you want to know why, hold a looking-glass in front of your mouth once or twice while you cough and note the result.

3. The only cough which is useful is that which easily brings up sputum; all other is harmful to you, and by practice you can control seventy-five per cent. of it by your will power. Do so.

4. If talking increases your cough, don't talk.

5. *Never swallow your expectoration. It is dangerous to you.*

6. Wash your hands often and clean your teeth two or three times a day.

7. Kissing may be an agreeable pastime, but until you are thoroughly well and have no more cough or expectoration it should be given up.

8. Should by accident the floor or anything become soiled by expectoration, it must be carefully wiped up *at once* with 1 to 20 solution of carbolic acid in water, and some of this solution allowed to soak in afterwards.

9. If these precautions are fully observed, *there is no need* for anxiety for yourself or others. Tuberculosis is not smallpox or scarlet fever, and among decently cleanly people it is with difficulty handed on to others.

CARE OF THE VOICE.

1. If hoarse or if you have any throat trouble, limit your speaking to the absolute minimum,—

complete silence is best. Each word is a physical injury to a weak organ.

2. Always avoid hot, dry or dusty rooms, but especially when hoarse.

3. Never strain your voice by calling people at long distances.

4. No smoking save as allowed *and no inhaling in any case.*

5. No singing without consulting the doctor. If your throat is not perfectly healthy, it will injure it.

MEDICINES.

1. None save as ordered.

2. Stop any that upset the stomach or spoil the appetite, and tell the doctor at once.

3. If possible, take them where others will not see you. Put yourself in his place.

4. No alcohol save where permitted.

MISCELLANEOUS.

1. *Remember that everything not expressly allowed is forbidden.*

2. Telephone the doctor when in doubt. It won't bother him and may save you from hurting yourself.

3. If you catch cold or feel badly, telephone at once.

4. In the beginning, if not used to fresh air, don't go too rapidly to open windows and outdoor life, but in a short time you will be able without

difficulty to live the life strictly and with pleasure.

5. Avoid following the advice of solicitous friends without first consulting the doctor.

6. One of the most dangerous times for you is when you reach the point where while not yet well, you feel perfectly so. Then it is that even the most prudent are apt to be imprudent and overdo. Remember that in this trouble the symptoms may all cease some time before the disease is really cured and that, excellent as it is to feel entirely well, only a careful physical examination and long observation can prove you so.

7. *Never talk of your case or symptoms with anyone but the doctor*, and allow no one to talk of theirs to you.

8. *Don't fret*. Fretting never helped anyone. If you cannot change conditions, an uncomplaining acceptance of them will not make them more hard to bear and often will reveal a silver lining to the darkest cloud. We take the sunshine as our right; why not accept the clouds cheerfully?

9. If thinking makes you blue, use your will power; stop thinking of that which worries you and think of something else. It is good practice for your will power.

10. When inclined to complain of the weather, remember the old jingle and don't.

As a rule a man's a fool.
When it's hot he wants it cool;
When it's cool he wants it hot—
Always wants what he's not got.

11. Don't be impatient to get well. It will only retard you. Nothing worth having in this world ever comes quickly or easily, and a good cure is often a slow cure.

12. The relation of the patient and the physician in this trouble is of more than usual importance; and if the results are to be satisfactory, complete co-operation and confidence between them is essential. The true nature of this relation is well shown by the following: A man owned a steam yacht on Lake Ontario which he managed himself in every way without the aid of anyone. He decided to go down the St. Lawrence to Montreal and started on the trip. The first night he stopped at the Thousand Islands and put in to the dock. Here a spectator asked him where he was going. "To Montreal." "But where is your pilot?" "Oh, bless you, I don't need any pilot, I always run my boat myself and need no help." "Well," said his interlocutor, "that may do very well on the lake, but there are three dangerous rapids between here and Montreal, with hidden rocks, whirlpools and other dangers in abundance, and you who know nothing about them are sure to wreck your boat."

The owner, therefore, went off and got a pilot, who, when he came on board, looked carefully over the condition of the boat in every part, and then said: "Now, please go down and stoke the boilers carefully and obey my signals from the pilot house in running the engine, for if you don't I cannot

possibly get you through; but don't come into the pilot house and bother me, for I have all I can do to get your boat safely through to Montreal. When we are through all the dangers I will turn your boat over to your own control and you should then be able to run it yourself under all ordinary conditions." Verbum sap.

13. Remember that to no half-hearted or light-minded seeker after health will healing come; and that the results are largely dependent upon the will power, intelligence and persistence of the patient; that the doctor can show you the way, but only you can walk in it. Keep up your side of the partnership with the doctor honestly; remember that you must work hard as well as he; be in earnest; cultivate your will power; be hopeful; be cheerful; see the bright side, for good spirits is the best medicine, and the sunshine of a smile can dissipate many a cloud.

CHAPTER XII.

A BRIEF ACCOUNT OF METHODS OF STUDY AND TREATMENT AT THE PHIPPS INSTITUTE.¹

I HAVE been led to present this, with the sanction of the Phipps Institute, for two reasons: First, I felt that the details outlined below would not be without interest to the profession at large; and second, it was acutely brought about, if the expression may be permitted, by having exploited to me, by two distinguished Philadelphia physicians at the last meeting of the American Medical Association, in Boston (June, 1906), certain methods of study and treatment (modestly suggested as worthy of imitation or adoption on our part) which had been in vogue at the Phipps Institute ever since its foundation. It is, therefore, with an apology for the technical character of this contribution, and also for any hint it may unintentionally convey of self-complacency on our part, that I present it here.

There are three aspects in which the work at the Institute must be reviewed: The clinical, the laboratory, and the educational or sociological side.

¹Read before the Pa. State Med. Soc., Bedford Springs, Sept., 1906.

I will consider only the most salient features of our work and will first review our clinical methods.

THE CLINICAL SIDE.

The principle carried out in the treatment of these cases is that of giving the maximum amount of study and care to the individual case. There is no hospital in this country nor Europe, so far as I have been able to observe, and I have looked into the matter widely, where every case is so accurately studied both clinically and pathologically, and where the records are so admirably symmetrical and so carefully kept as at the Phipps Institute. For the clinical and pathological records of any series of cases to be of the greatest value for statistical or other purposes, every detail of the cases must be systematically studied, and symmetrically and accurately noted. This is only possible where printed forms are used, and a glance at the record sheets of the Institute will speak for itself. (Published in Second Annual Report.) It is not enough to have printed forms, but they must be unfailingly and accurately filled out in every case. This in regard to the clinical records is indirectly accomplished at the Phipps by having two history committees, one of the house staff, and the other of the dispensary staff, who go over the history records of the new cases at stated intervals, and report as to any omission they may find, not only to the individual physician in charge of the case, but to the assem-

bled body at the weekly meetings of the staff. All omissions must then be filled in at the next visit of the patient. Every record must thus be completely filled out, all the data of symptomatology and physical examination must be reported upon either negatively or positively,—it is a *sine qua non* of remaining a member of the staff.

It follows that for even the most skilled and quickest worker, it requires at the very least an hour, to an hour and a half, to report on every new case. The great advantage of this system, to my mind, is not so much in the perfect records resulting, as in the training inevitable in those carrying it out—a kind of training with its painstaking scrutiny of detail which is so essential for those who would fit themselves for the study and treatment of tuberculosis.

It follows therefore that the admission of new cases to the wards,—on account of the number of beds, and to the dispensary service on account of the detailed study required in each new case,—is necessarily limited. This might at first sight be considered as reducing the efficiency of the service at the Phipps in regard to mere numbers, but it is compensated for and overshadowed by the thoroughness of the service in regard to the individual case—which is after all the fundamental principle in the study and treatment of this disease.

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The ward cases are necessarily limited to 52,¹ the number of beds available. There are eight physicians in charge of the wards, so that each has under his immediate care approximately seven beds. Only cases too far advanced or too ill for dispensary treatment are referred to the wards, in which they remain for a variable period, as a rule three months or longer. There is thus ample time and opportunity for their clinical observation. It follows that there is usually a long waiting list for admission to the wards. Sometimes it takes six weeks or two months before there is a vacancy. Patients are admitted in the order in which they apply. .

The same is true of the dispensary service; though the waiting list is not so long, it usually requires about three weeks before a patient can be seen after application to the office. It differs in this from routine dispensary service where all cases are hurriedly, and too often, carelessly seen. Under the detailed study required in each case at the Phipps, it is impossible for the physician in charge of a dispensary service to see more than one new case (and his old patients) a day. There are twelve physicians in charge of this service, each with two clinics a week, there being daily clinics at 11 A.M. and 2 P.M.

There were 195 new cases admitted to the wards

¹The figures quoted throughout are taken from the Second Annual Report.

during the past year, giving an average per man, on the house staff, of 22 new cases a year. There were 690 new cases admitted to the dispensary service, giving an average per man on the dispensary staff of 58 new cases a year.

These figures represent new cases only, as there was a grand total of 1561 patients treated, of which 1382 were seen in the dispensary and 294 in the wards; 115 were treated both in the dispensary and wards.

Old patients must return to the dispensary at least once in every two weeks; if a month elapses they are discharged *ipso facto*. The record of the respiration, pulse, temperature, and weight, is taken at each visit, and notes made of the treatment and progress of their condition. A full examination of the chest is required in every case, once every month in the wards, once every three months in the dispensary. I want to repeat that this system in all its details is not left to the happy co-operation or passing fancy of the physicians in charge, but is unequivocally required. No assistants are allowed; every man must do his own work and be responsible for it.

After the patient has been examined on his first visit, he is given sputum cups, paper napkins, and bags for the street; a printed list of rules to follow, and is fully instructed, first by the physician in charge and subsequently by the clinic nurse, who gives him his supplies, as to prophylactic measures. It goes without saying that his treat-

ment is carefully outlined for him, and if he is poor he is given a daily allowance of milk, up to four quarts.

Following his first visit, and every two weeks thereafter, he is visited at his home by an inspectress from the Institute, who instructs him and his family in the details of treatment, sees that the rules of the Institute are posted up in his home, and sees further that the directions and regulations are carried out. This is, of course, very essential, as left to themselves these cases, many of whom are ignorant and careless, cannot or will not follow instructions however carefully laid down. Part of the nurse's duty is to select his room for him, show him how to avail himself of the greatest amount of fresh air and sunshine, where possible by camping out on the roof or making use of a yard or porch; she also sees that he sleeps alone, follows instructions in regard to rest and diet, and the many other details of treatment which are so essential to a successful issue. The printed rules of the Institute and the blanks for the inspectresses' reports, which are incorporated with the history of each case, may be seen in the Second Annual Report of the Phipps.

In addition to the clinical study of the condition of the lungs and the cardio-vascular system, and a most detailed report on the rest of the body, by the physician in charge, the case is referred for further examination to the various specialists on the staff for examination or treatment as may be



FIG. 8.—Free milk at the Phipps Institute. Patients come daily at 8 A. M., and bring a can for their daily allowance.

necessary. Their reports, which may be seen, as above, are again incorporated with the original history of the case. There are five clinics in the specialties, *i.e.*, in laryngology, neurology, dermatology, ophthalmology and genito-urinary diseases.

Every case in the wards or dispensaries is at the disposal of any member of the staff for examination and special study, so that all clinical material is available for those making special clinical or pathological studies of any feature or organ in tuberculosis. It is no uncommon thing for a case, particularly in the wards, to have a half dozen chartings of the condition of lungs and heart made by as many members of the staff—some to be confirmed, others to be disproved by the subsequent autopsy.

Every Monday evening throughout the year, excepting during July and August, there is a meeting of the staff at the Institute. The members of the staff are not left to the promptings of their own sweet wills in regard to attendance on these staff meetings—regular attendance is required. Let me say that we are under a strong hand and a wise head, yet colleagues and hearty co-operators with the director in every sense; but strict business principles, modified it is true by the professional viewpoint, are followed throughout in the executive administration of the Institute.

At these weekly staff meetings every phase and feature of tuberculosis sooner or later comes up

for discussion. Individual cases are sometimes shown, pathological reports, the question of drugs and treatment, the work of others, the latest literature—all come up for informal discussion or analysis under the moderatorship of Dr. Flick in the chair. We convene at half-past eight and never adjourn until ten-thirty, more often eleven o'clock. It need hardly be pointed out that these meetings are of inestimable advantage in many ways, not only educationally to all concerned, in thrashing out views and experience, in developing ideas and stimulating fresh endeavor along new and old lines, but also in developing a mutual regard and close acquaintanceship, which is such an important factor not only in the welfare of the individual, but also in that of the Institute. Indeed, I do not want to be accused of sentimentality or partisanship when I say we are brothers, with one view and one aim. There are no jealousies, and the aims of the Phipps come first.

During the past year, lest this close association should result in narrowness, we have arranged a plan whereby at stated intervals men distinguished in this work are invited to address us. In this way during the past year others have come to us and given us the benefit of their views and experience upon one or another of the many interesting phases of this disease.

In concluding this section of my paper let me in all modesty call attention to the right of the Institute to be heard and to speak with authority. The

experience of the staff of the Institute, with its large opportunities for both clinical and pathological work, is truly vastly greater than any other group of men in this line of work (certainly in this country). Aside from the material at the Phipps, through staff appointments in other hospitals, we control 621 beds,¹ fully three-quarters of the hospital resources available for tuberculosis in Philadelphia and its vicinity. It follows, too, that our experience from private work is very wide, speaking collectively, for it must be admitted that the laity are alive to the question of tuberculosis and that if not at once, sooner or later they seek out those specially interested in or identified with this disease. All of this experience reacts to the advantage and benefit of every member of the staff, because directly or indirectly it is analyzed and thrashed over in his presence every Monday night.

THE LABORATORY SIDE.

No medical institution can have the fullest usefulness or accomplish its highest purpose, in which laboratory investigation or scientific experimentation is not part of its life. Inevitably it must drop

¹	Beds.		Beds.
Phipps	52	Fern Cliff.....	40
Philadelphia Hospital	180	Orchards	15
White Haven.....	190	Dermady	25
Sunnyrest	60	Chestnut Hill.....	20
Lucien Moss Home,			—
Jewish Hospital...	39	Total	621

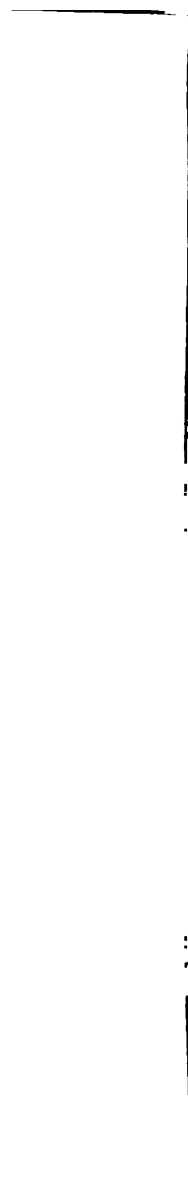
behind in the march of progress, eventually must cease to have a higher purpose than that of routine or local usefulness. It is only where aims are high and altruistic, where much is attempted and striven for, where much is dreamed of and hoped for, that a little of the true harvest of accomplishment is garnered.

Not secondary to the clinical side of the Phipps, but going hand in hand with it, is its more strictly scientific side. Of course routine examination of urine and sputum are made and repeated in each case, but it is not of that I would especially speak. Conditional for admission to the wards is the execution by the patient and his nearest relative of permission for an autopsy in event of death at the institution. Every case which dies in the Phipps Institute is posted. Every member of the staff is notified by mail of the hour at which the post will take place. During the past year out of 294 admissions to the wards there were 88 deaths with autopsy.

The autopsy examinations in these cases are most exhaustive from the pathological point of view, as may be seen from a glance at the published record sheet (Second Annual Report) of the pathologist. In addition to the examination and report on the entire body, cultures are taken of all the organs. Finally, sections of all the tissues are made and careful histological reports made in every instance. Interesting specimens are preserved in the pathological museum.



Fig. 9.—Corner of a room in old laboratory. New laboratories adjoining the Institute, have been fitted up and thoroughly equipped during the past year.



To certain members of the staff the various organs are assigned for detailed examination and study. Opportunity for special research is made possible through the setting aside of a certain sum of money available for the endowment of 11 scholarships open to members of the staff, and the establishment of well equipped laboratories. These scholarships vary in amount from two to twelve hundred dollars, and are assigned according to demonstrated ability or special interest in a given subject upon the part of a particular member of the staff. They apply not only to strictly pathological or bacteriological work, but also to investigation along sociological and clinical lines. A scholarship, involving as it does a special line of exhaustive research, is not to be lightly undertaken, for much is demanded of its recipient. The work is definitely mapped out in all its details, and the amount of time to be spent daily in the laboratory is definitely set forth. The scholarships cover a period of one year, and are very far from being sinecures.

These scholarships were not available during the first two years of the Institute's life, but an idea of the kind of work required and the fitness of the members of the staff to carry out such work, may be had from the authoritative and splendid monographs of Pearson and Ravenel on immunity in animals and man, respectively; from McCarthy's work on the nervous system; from Walsh's pathological and clinical studies of the

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known from Thom's studies of the liver—published in the Second Annual Report: not to mention scientific and clinical studies published there and elsewhere by Charles Samuel Irwin, Carnotus, Irving Morris and others.

Following the death and autopsy of a patient, the case comes up for analysis and discussion at a weekly staff meeting in relation to the clinical findings. The physician who had charge of the case reads the history and demonstrates on the blackboard the physical signs as he elicited them and the factors influencing his diagnosis. The pathologist follows with his report of the post-mortem findings with the morbid specimens on the table before him. Following the report of the pathologist the bacteriologist makes his report on the results obtained by staining methods, culture products and animal inoculation. Under microscopes on another table are histological sections of the various organs and tissues.

A recess is then taken to study the various exhibits. The meeting reconvenes, and a general discussion follows, and woe to him of the staff who has overlooked a cavity or failed to locate an empyema, or whose diagnosis may be at fault in other particulars! It is ever the tongues of our friends which are the most merciless and the most poignant. Let me add in justice to the members that while errors and discrepancies do occur, yet in general it is really quite remarkable how accurate and complete the clinical diagnoses are. The



FIG. 10.—A corner of the pathological museum.

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kidney; from Ullom's studies of the liver—published in the Second Annual Report; not to mention scientific and clinical studies published there and elsewhere by Landis, Stanton, Irwin, Carn-cross, Craig, Norris, and others.

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FIG. 10.—A corner of the pathological museum.

clinical diagnoses are not confined to the condition of the lungs alone; but the heart, liver, kidneys, intestines, and other organs are reported upon; and it is surprising how often congestion and tuberculosis of the liver, ulceration of the intestines, or miliary tubercles in the kidney will be diagnosed correctly, when the clinical data justifying the diagnosis might easily have escaped less detailed and expert examination.

THE EDUCATIONAL OR SOCIOLOGICAL SIDE.

The primary purpose of the founder of the Institute was, of course, philanthropic; and much attention is given not only to curing patients and alleviating human suffering, but also in the furtherance of the crusade against tuberculosis. The wards of the Phipps in taking advanced, dying cases out of their squalid surroundings, where they are most dangerous to others, accomplish a great work in eliminating foci for the spread of the contagion; the dispensary service with its careful instruction in prophylaxis, its constant supervision of cases by regular inspection and by furnishing them with prophylactic supplies, enhances further its influence in this direction. But it is chiefly from the education of the public through its individual members and the stimulation of their active co-operation that the greatest strides in preventive medicine must come. With this in view the members of the staff

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in response to invitations from all over the state and from all kinds of philanthropic and educational organizations, are constantly being sent to deliver lectures or read papers. There have been during the past year more than thirty-five such lectures delivered. The results of these efforts are not insignificant!

The members of the staff of the Phipps Institute took an active part in bringing the tuberculosis exhibit of the National Association to Philadelphia, under the auspices of the Pennsylvania Society for the Prevention of Tuberculosis. This can readily be inferred when I say that the President, Secretary, and eleven of the fifteen directors of the Society are members of our staff. Of the twenty popular addresses given by physicians during the sojourn of the exhibit in Philadelphia, (where it was attended by over 58,000 people, more in fact than saw it in New York and Chicago combined) nine were given by members of the Phipps staff. Four members of our staff are directors in the National Association for the Study and Prevention of Tuberculosis.

In conclusion, let me briefly recapitulate the salient features discussed at greater length above:

1. The maximum study and care of the individual case.
2. Careful study of all clinical data, and its accurate and symmetrical recording in every instance.

3. Stated periods within which re-examination and a complete recharting must be made in every case.

4. Special committees to examine the clinical records and report to the physician in charge and to the general body of the staff as to their condition.

5. No assistants; everyone responsible for his own work.

6. The sense of responsibility to the Institute and to the standards laid down thus developed.

7. The features of the weekly staff meetings. Every man's work subject to report and analysis. Everyone's experience and ideas at the disposal of the others. Special lines of treatment, research work, and other phases of the subject repeatedly thrashed out.

8. All cases dying in wards posted, followed by the complete pathological, bacteriological, and histological report of the case at a staff meeting, with the morbid exhibits, in conjunction with the clinical history, physical signs, diagnosis and treatment.

9. Scholarships and opportunities for special research.

10. The influence of the Institute along sociological and educational lines.

Finally, then, I have attempted briefly to tell a little of the story of the Phipps. Much may be inferred from what I have left unsaid. I hope

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well to tell the patient frankly his condition, and I have not appeared to make any unjust claims or arrogate virtues which we do not possess. If by mischance such should appear to anyone, I will ask that it be put down to my own enthusiasm and that the entire responsibility for it be borne by myself.

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